GAS JOURNAL

VOL. 273. No. 4682 105TH YEAR FEBRUARY 25, 1953

UNIVERSITIES AND INDUSTRY

THE gas industry with its long and inspiring record of close co-operation with the University of Leeds is second to none in its recognition of the importance of liaison between the universities and industry, but it has never allowed its enthusiasm for a progressively higher standard of educational attainment to obscure the fact that the opportunities it can offer to graduates are not infinite. It may well be that the nationalised gas supply industry, with its wider administrative horizon, will be able to absorb a few more graduates than the former individual undertakings but so far as the design and fabrication of gasworks plant and the manufacture of appliances are concerned there are fairly clearly defined limits. The Federation of British Industries has recently issued its report of the second Universities and Industry Conference held at Leamington Spa last October under the auspices of the Federation and a Committee of Vice-Chancellors and Principals of the Universities of the United Kingdom and attended by representatives of the nationalised gas and electricity industries, leaders in many fields of private enterprise, and specialists in administration and management. It concludes that industry must attract a larger proportion of those who possess high intellectual ability and of those who combine average ability with good qualities of personality; that industry must do more to explain its nature and purpose to the nation and to persuade potential entrants that it provides a purposeful career with opportunities for using good brains in essential work; and that much remains to be done to broaden the education of the university graduate. It sounds a warning that for most technical industries only 4% of the total employees fill scientific, administrative, and management posts for which a graduate could appropriately compete.

Mr. A. G. Grant, of Whessoe, Ltd., was one of three contributors to a session on 'What should and can industry do with the graduate recruit when it gets him?' The other two were concerned with the supply of consumer goods to millions of people through shops; Mr. Grant approached his task as representing a company producing gasholders, bridges, blast furnaces, power stations, and oil refineries, counting its customers in hundreds only and handling each year hundreds rather than thousands of projects, costing, however, anything from £1,000 to £1 mill. each. In Whessoe, Ltd., with 1,500 employees, there are only 80 posts which require and give scope for the sort of qualities and abilities expected in the graduate. Of these only 30 are in fact filled by graduates; the other 50 by first class men who served a traditional apprenticeship. The graduate in the future will have to be good to equal the fine abilities which these non-graduates throughout Britain's industrial history have brought to engineering firms. Of the 80 posts defined as being appropriate to graduate competition there are five in higher management, 11 in departmental management, 22 in various semi-technical and administrative levels, and 48 where individual ability and initiative predominate but there is little scope for group leadership. It is noted that these numbers are in almost geometrical progression of 1:2:4:8—a progression which exists in all industry and in most other human activities, and which means that a man at one level has only one chance in two of reaching the next, and that a graduate entering a firm has only one chance in eight of reaching higher management. The same geometrical progression, it appears, operates in the Royal Navy, with twice as many vice-admirals as admirals; twice as many rear-admirals as vice-admirals; and twice as many captains as rear-admirals. Sir Norman Kipping, Chairman of the session, commented that there seemed to be just about enough people who possessed the necessary qualifications for the structure of organisation and it would be wasteful to train more people than were ever going to reach the upper grades in those kinds of subjects that only the upper grades were likely to need.

Having defined the limits set by his company's operations and staff structure which, quite broadly, may be said to represent the majority of the firms carrying out gasworks contracts, Mr. Grant claimed that it can and does offer a graduate worthwhile work and opportuni-

ties; it converts him into a professional man and gives him a good and exciting life in the process. It cannot offer long-term prospects of promotion, but it impresses on the graduate that he is not entering the company for life but rather that he is entering industry, and if he chooses to move elsewhere to widen his experience the company is proud that he has learnt his profession there. It feels that the old 'journeyman' idea whereby an apprentice after completing his time went to work for others is a sound principle applicable to graduates as well as to apprentices. It probably has too much rigidity in its staff structure and 'we might well study the methods used in the navy and civil service whereby frequent transfers enable young men to be given experience and tested for a variety of work and responsibility.'

The conference report records that at the opening session Sir John Maud, Permanent Secretary of the Ministry of Fuel and Power, discussing how the civil service uses the university graduate and which of his qualities had proved most valuable, paid well deserved tribute to graduates holding administrative posts, particularly in the Ministry in which the gas industry is mainly interested. His only criticisms concerned the few who never remove their pipes when talking, and the somewhat larger number who, being monolinguists, are at a disadvantage when meeting Continentals. A small number are snobs—and if there is one thing a person who has had a university education should not be, it is a snob.

SAFETY AND THE UNFORESEEN

THE Gasworks Safety Rules Committee is to be warmly and gratefully congratulated on the publication of what is promised to be only the first of a series of booklets giving all the relevant details of some of the accidents reported to them and from which they hope that valuable lessons will be learned by designers and constructors no less than engineers and operators. It is upon the mass of reports of accidents which have previously come into their hands that their Safety Rules have been based, but it will be immensely valuable to all concerned to have details of actual and individual cases brought to their notice.

The first two accidents reported in this publication are indeed striking examples of the need of foresight and imagination in the design and installation of plant. The first arose out of the installation of horizontal retort charging machines in buildings too cramped for them. We are not sure that the lessons set out in the booklet are exhaustive. But without still more knowledge of the site and the circumstances we should not care to hazard a guess as to what further might be learned. We can but hope that pretty drastic steps have been taken, as no doubt they have, to remove the danger both by way of increased clearance and by modification of the communications between one house and the other and the method of removing spillage.

The second accident was more dramatic. The deadly danger of ultra-slow moving machinery is emphasised and the lesson to be learned, one of design, was obvious. It shows that the safety rule, never to reach over, much less through, any sort of gearing without bringing it to a standstill, should be observed even with the very slowest-moving gear.

The somewhat objectionable adjective 'foolproof' and its implication were rather well discussed at the autumn research meeting. Sometimes the attempt to fence and shield can result in putting the danger out of sight rather than removing it. Sometimes the moving plant is better kept in sight and well lighted so that the careful operator can see and avoid it. Fencing and shielding may hinder access for necessary attention while it does not remove the necessity to stop the plant for lubrication or adjustment. The deduction from the belt conveyor drum accident (indefensible enough in itself) raises another point: 'Guards which may not totally enclose the danger area must include a distance sufficient to keep the operator away from it.'

Responsibility for avoiding accidents due to explosions or gassing in any part of the wet or dry purification plant must rest upon a technician so trained that he instinctively as well as intelligently realises the danger of such occurrences. Increasing attention to oxide purifiers in accordance with modern techniques appear likely to increase the risk. And it is pointed out, too, in this booklet that the introduction of the electro-detarrer has brought with it another source of risk which design and practice have not yet mastered. Explosions arising out of access to naked flames of gas escaping in exhauster houses are however—or to be charitable we should say, were—so common that there is really no excuse for them. The Code of Practice in this respect is so excellent and exhaustive that it should be followed without question throughout the industry. One wonders whether accidents still reported with gasholders—we are glad to read that these have decreased considerably recently—are due to some extent to the reluctance to scrap old and inadequate holders when the time is ripe, though the money is not ready, to provide new and larger storage. Electrical hazards are always with us; they will best be reduced to the minimum by close collaboration between electrician and gas technician. And it was good to call attention to dangers attendant upon the use of tar and other liquid fuels for firing steam boilers. Both the accidents reported would seem to have resulted from inexperience and a failure to appreciate what was really going on in the plant.

The maintenance worker and the contractor's workman are to some extent in the same category. Both are called upon to work in situations where they must provide their own safeguards. The former must sometimes remove the guards and penetrate the danger zone, the latter is called upon to work before the guards are in position. The contractor's designer may help the maintenance engineer by providing access not only for operation but for repairs and maintenance; he can only assist his own erector by providing as often as possible specialised tackle for difficult and dangerous erection. There is perhaps still too little expenditure on means of access to steel constructions for painting and inspection.

INSPECTION IN INDUSTRY

A BRITISH SPECIALIST TEAM on inspection methods in industry visited the United States in 1951 under the auspices of the Anglo-American Council on Productivity. The team of eight, led by Mr. L. Sollis, Managing Director of the Highfield Gear and Engineering Co., Ltd., saw 22 plants mostly engaged in the light engineering and non-ferrous alloy industries and subsequently visited eight plants in England, including the gauge and automatic inspection department of the Sigma Instrument Co., Ltd., and the weighing and testing equipment of W. & T. Avery, Ltd. The British Productivity Council (formerly the United Kingdom Section of the Anglo-American Council) has now published the team's report, which declares that the best British practice in inspection is not behind the best in America. There is, however, a larger enthusiastic following in the United States than is evident here. A new and broader conception has been taken of the words 'quality control'; inspection is held to be part only of the wider function of co-ordinating all the influences on quality. The recommendations of the team fall into two parts. First there are recommendations of a general or national character which require group or national action; second, in keeping with the detail of the report, there are recommendations on the steps to be taken by a firm wishing to employ the most modern techniques. These include proposals that formal links should be established for the interchange of quality information between departments, and the setting up of quality action committees to translate information into positive action. It is urged that the management should endeavour to create and build up a co-operative spirit throughout the organisation in order to bring about more effective use of materials, equipment, and man-power, which must result in greater productivity. The team believes that the quality department is a focal point for the development of this spirit. The recommendations are applicable to small and large firms, there being no difference of principle but only of degree between the requirements of the two.

The report is the latest addition to a growing library compiled by productivity and specialist teams sent over to the United States to see how far American methods could be applied to the improvement of industries in Great Britain. We await with interest the report of the gas industry team which visited America a year ago.

Personal

Mr. A. H. Savill, Divisional Assistant Engineer of the West Surrey division, South Eastern Gas Board, has been appointed Deputy Divisional Engineer of that division.

◇ ◇ ◇

Mr. C. A. E. Reed has been appointed Station Engineer at Tunbridge Wells in succession to Mr. G. J. B. Cox, now Engineer of the Scottish Gas Board's Edinburgh division. Before leaving Tunbridge Wells Mr. Cox was presented by Mr. J. Hyde, Group Manager, on behalf of his colleagues, with a gold watch as a token of good wishes.

◇ ◇ ◇

Miss Mary Danby, laboratory and research worker at Hendon gasworks, Sunderland, has been elected the first woman member of the Northern Junior Gas Association. Miss Danby studied chemistry at Sunderland Technical College, and for the past 18 months has been engaged on general testing and analysis of coal and by-products.

◇ ◇ ◇

Mr. B. C. Hinwood, while continuing in his present appointment as Station Engineer at East Greenwich, has been appointed Deputy Divisional Engineer of the South Eastern Gas Board's Metropolitan division. In the same division **Mr. W. H. Herbert** has been appointed Divisional Mechanical Engineer, **Mr. W. H. Kingsbury** Divisional Chemist, and **Mr. T. W. Doran** Personal Assistant to the Divisional Engineer.

◇ ◇ ◇

Mr. H. Atlee Hunt, Distribution Superintendent of the Trowbridge and Bradford units of the South Western Gas Board, was among the New Year Honour recipients who were invested with the M.B.E. yesterday (Tuesday). Fifty years ago he became a pupil of the late Mr. George Helps at Nuneaton. After some years with the Ceara Gas Company, Brazil, he went to Bradford-on-Avon in 1921. For a short period during the war he managed two works for the British Gas Light Company in Essex, subsequently returning to Wiltshire. His recent honour is in recognition of his work as Chairman of the Trowbridge and West Wilts Youth Employment Committee.

Obituary

Mr. John King, of Oak Lynn, Dore Village, Derbyshire, Chairman of Directors of John King & Son (Enamellers), Ltd., vitreous enamellers, Pyro Works, Whittington Moor, Chesterfield, died suddenly at his home on February 8, aged 54. With his father, he established the business in 1929, and he had been chairman since the death of his father in May, 1952. He was also associated with the Richmonds Gas Stove Co., Ltd., Warrington, and King, Taudevin, & Gregson, Ltd., Sheffield.

Diary

Feb. 26.—North Thames G.C.C.: Caxton Hall, Westminster, 2.30 p.m.

Feb. 26.—Midland Section, I.G.E.: Joint Meeting with Institute of Sewage Purification; 'Further Experimental Work on Gasworks Liquor Treatment,' A. J. Clifford and J. T. Rees; Birmingham Chamber of Commerce, 2.30 p.m.

Feb. 28.—Manchester Juniors: Annual Dinner, Lyme Park, Disley, Cheshire.

March 3-28.—Ideal Home Exhibition, Olympia. Gas Council stand No. 70, Grand Hall, ground floor.

March 3.—South Eastern G.C.C.: 4, Wandsworth Road, S.W.8, 2.15 p.m.

March 3.—East Midlands G.C.C.: Leicester and County Chamber of Commerce, Granby Street, Leicester, 11.30 a.m.

March 4.—Southern G.C.C.: Social Welfare Club Room, Reading Gasworks, Kings Road, Reading, 2.30 p.m.

March 7.—Scottish (Eastern) Juniors: Joint meeting at Glasgow. Paper by W. K. Tate, Junior Vice-President, Institution of Gas Engineers.

March 11-12.—Gas Sales and Service Conference, Seymour Hall. (For full programme see *Journal*, January 14, p. 91.)

March 13.—London Juniors: 'Southampton's Gas Distribution System,' R. K. Harrison. 178/180, Edgware Road, W.2, 6.30 p.m.

March 16.—Eastern G.C.C.: Connaught Rooms, Kingsway, W.C.2, 2 p.m.

March 17.—London and Southern Section, I.G.E.: 'Firing of Pottery Kilns by Gas,' A. F. Searle.

March 17.—Midland Juniors: '25 Years' Experience on a Chemical Works,' H. Alridge, Birmingham. Staff Mess Room, West Midland Gas Board, Council House, Birmingham.

March 18.—Eastern Juniors: Stamford; Visit to the Works of Williamson Cliff Refractory Co., Ltd.

March 18.—South Western Section, I.G.E.: Cheltenham. 'Integration and the Scope for Development,' T. W. Jackson; 'Some Aspects of Works Management,' T. N. Dent.

March 18.—Manchester Juniors: Visit to Davyhulme (Manchester) Sewage Works, by invitation of Manchester Corporation Rivers Department. 'Treatment of Industrial Effluent.'

March 19.—London Juniors: All day visit to Chesterfield Works of the Staveley Iron and Chemical Co., Ltd.

March 19.—Wales Juniors (North): Visit to works of C. R. Averill, Ltd., Caergwrle; talk on 'Painting Problems' by a member of the technical staff of C. R. Averill, Ltd.

March 21.—Midland Juniors: Annual Dinner; Imperial Hotel, Birmingham.

Building Centre Ceremony

Sir Harold Smith Opens New Gas Section

Examining the illuminated map showing the boundaries of the twelve Area Gas Boards are seen (left to right) Sir Alfred Hurst, Chairman of the Building Centre Council, Colonel Sir Harold Smith, Chairman of the Gas Council, and Mr. Frank Yerbury, Director of the Building Centre.

THE contribution which gas can make towards solving the problem of homes without hot water services, was stressed by Colonel Sir Harold Smith, K.B.E., D.L., when he welcomed members of the architectural, building and technical Press to the newly designed 'Gas in the Design for Living' Exhibition at the Building Centre, 26, Store Street, W.C.1, on February 17. Sir Harold said that, in a country such as ours some of the recent facts and figures on domestic hot water were disturbing, and he quoted the figures given in a recent report that out of 14¼ mill. dwellings in Great Britain, over 5 mill. had no fixed bath; over 2 mill. had no water heating appliances other than kettles and pans. Even where there was no existing hot water supply in the home, said Sir Harold, gas could help to solve the problem, for instantaneous and storage water heating appliances could be connected to the cold water supply and would give hot water on tap so necessary for cleanliness and health.

Fresh Laurels

Of the Building Centre, Sir Harold said that it needed no introduction, as its importance as a central source of up-to-date information and display in the spheres of construction, building materials and equipment had long been established, and now housed in these new and spacious premises, it had added fresh laurels to its already unique reputation. Referring to the presence of many appliance manufacturers, whose products were on view in the new exhibition, he felt this was a happy example of the close co-operation between the nationalised gas industry and the makers of gas and coke-burning equipment. 'Our aim,' he said, 'is to keep abreast with the latest developments in design and performance and to provide a wide field of selection.' Appliances would be changed from time to time so that manufacturers would have an opportunity of showing their latest wares.

In reply, Sir Alfred Hurst, Chairman of the Building Centre Council, said that their relations with the gas industry before the days of the Gas Council, and still more since it was formed, had always been harmonious. There was a time, just after the war, when they were a little dubious whether these newly formed State monopolies for gas, electricity and coal might not consider it wasteful to carry on propaganda, each advertising its own way of heating and lighting. However, to the satisfaction of the Centre this was not so, and he hoped that they would continue to exercise to the best of their ability, their powers for extending custom and developing satisfactory appliances for our homes.

He looked forward to competition between the monopolistic industries; and this exhibition was very significant in that on one floor there was the gas industry displaying its services, with electricity close by, and on the floor above, the Coal Utilisation Council with their apparatus for making use of solid fuel, all of them very happy to maintain competition. In conclusion, Sir Alfred congratulated the Gas Council on their exhibition. He himself was afraid to bring his wife to see it, as he was sure she would want to scrap all her appliances in favour of the ones on display.

The new gas section was described and illustrated in a special *Gas Journal* article on p. 88 in the January 14 issue.

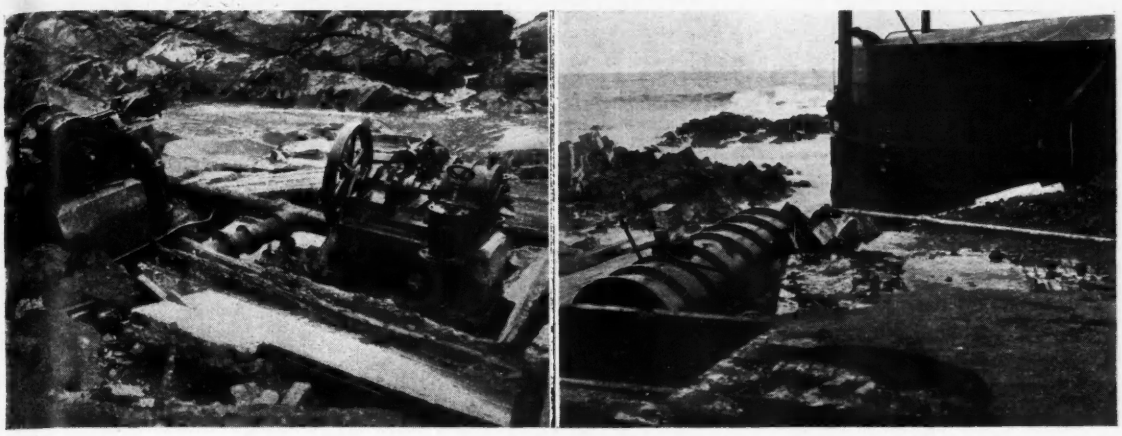
Hurseal's New Policy.—A change of sales policy is announced by Hurseal, Ltd., 229, Regent Street, London, W.1, manufacturers of heating equipment. Instead of using sole agents in certain parts of the north of England, the firm will now deal direct with wholesalers and retailers. A branch office and store has been opened at 317, Chester Road, Sutton Coldfield, Birmingham, and another at 23, Strutt Street, Manchester,

The Woodall-Duckham Company have received an order from the Guest Keen Baldwins Iron and Steel Co., Ltd., to build a complete new coking plant at their East Moors Works, Cardiff. The new installation will comprise a battery of 46 W-D Becker underjet coke ovens divided into groups of 31 and 15 ovens, with a complete set of oven machines, and a coal bunker of 2,200 tons capacity; coal crushing, handling and blending plant with blending bunkers of 2,000 tons capacity; by-products recovery plant of the semi-direct type, and a benzole plant to produce motor benzole, etc. This is the fourth installation of W-D Becker coke ovens to be built at the East Moors Works which, when the new installation is completed, will have a total coal carbonising capacity of 2,680 tons per day.

The Ford Blast Furnace, affectionately known as 'Josephine' by workers at the Ford works, Dagenham, has broken a national record by exceeding a figure of 1,553,766 tons of iron produced without relining. This has been accomplished in only 99 months—nearly two years better than the previous record. The furnace has been producing iron of a high silicon content as opposed to basic iron on which the old record was established and has done so using less coke per ton of iron produced. 'Josephine' which is the only blast furnace in the South of England and only 12 miles from London, began operating in 1934 and in 19 years has produced well over 3 mill. tons of high quality iron.

The Proceedings of the National Smoke Abatement Society's Portsmouth Conference last September are now available in booklet form, and copies are obtainable from the offices of the Society Chandos House, Buckingham Gate, S.W.1 (price 6s.; by post 6s. 2d.). It contains a complete report of the conference, including Professor F. E. Tylecote's presidential address, the Des Voeux Memorial Lecture, on the subject of 'Smoke and the Law' by W. R. Hornby (standing counsel to the Society), progress reports, and other papers.

SCENES OF DEVASTATION AT THE BANFF GASWORKS



We recorded in last week's JOURNAL *the remarkable achievement of the Scottish Gas Board's Northern Division in getting the Banff gasworks back into normal production in only nine days after the destruction by the sea on January 31 of many major items of plant. The above photographs give some idea of the havoc wrought by the storm.*

Coal Price Increase

THE National Coal Board is raising the pithead price of all coals for inland destinations (including coal shipped coastwise or as coastwise or trawler bunkers) by 10% as from March 2. This represents an average of 5s. 6d. per ton.

The last national increase in the pithead price of coal was made on December 31, 1951, and was intended to meet the increasing costs of production, including wages, which were then being experienced. The Board's wages bill has continued to increase during the past year, and there have been increases in costs in other directions. Consequently, the Board's accounts for 1952 may be expected to disclose a considerable deficit to add to the deficit of £6 mill. brought forward from previous years. It is the statutory duty of the Board to balance revenue and expenditure over good years and bad. The Board and the National Union of Mineworkers have agreed to co-operate in measures to increase production in 1953.

The price increase does not apply to exports and foreign-going ships' bunkers, and the Board bears the increased cost of miners' coal and coal used at collieries. The approximate yield in 1953, including opencast, is expected to be £43 mill.

Long Service with Edward Cockey

BELIEVED to be the first social function of its kind in the history of the firm, which dates back over 100 years, 160 employees of Edward Cockey & Sons, Ltd., and their wives and friends had a successful dinner recently. During the evening three directors and twenty-six employees were presented with silver tankards to commemorate at least 25 years' service.

The long-service employees of Edward Cockey & Sons, Ltd., with their presentation silver tankards.

In welcoming the guests, Mr. Clifford Holmes Hunt, M.A., ASSOC.M.INST.GAS E., gave a short resumé of the history of the firm. He believes that further back than recorded history the company carried on as bell-makers. As the gas industry developed so they turned to gas plant. Mr. R. L. Button, in a short speech, bore out Mr. Hunt's remarks about bell-founding by the inscription on a bell in Frome which reads:—

God made Cockey
And Cockey made me
In the year of Our Lord, 1743.

He paid tribute to Mr. Hunt and Mr. W. A. Perkins, F.I.A.C. (Director and former Secretary), and referred to them as saviours of the firm 25 years ago, and he recorded his pleasure at Mr. S. T. Franks joining their staff. Mr. Peter Perkins (Secretary) proposed the health of the guests and Mr. A. C. Rea, M.INST.GAS E. (Production Engineer, Bath Sub-Division, South Western Gas Board), responded.

Southport Lighting

SOUTHPORT Corporation Lighting Committee is to protest strongly to the Ministry of Fuel and Power and the North Western Gas Board against the increase in the price of gas for street lighting, and the local Member of Parliament, Mr. Roger Fleetwood Hesketh, is to be asked to make representations on behalf of the town.

Councillor A. H. Allen, Chairman of the Lighting Committee, said that before the war the price of gas for street lighting was 6.66d. a therm. After nationalisation it jumped to 9.5d. per therm and then to 11.5d. The new proposed increase brought the price to 12.25d., which was a huge increase. Nationalised gas undertakings should show more consideration to the large consumer, he said.

Alderman Sir Herbert Barber, Chairman of the Corporation Finance Committee, said in view of the increased price of gas the policy of the Lighting Committee in changing over from gas to electricity for street lighting was fully justified. He hoped it would not be long before gas and electricity boards were made responsible to Parliament. Nationalised undertakings were supposed to be owned by the public, and M.P.s should be entitled to ask questions about them.

The Lighting Committee is inviting tenders for the installation of sodium lighting in a number of main roads. It was intimated there would be a big saving by the new lighting scheme.

A Pioneer of Accident Prevention

THE Birmingham Accident Prevention Council has published under the title of the *Safety Campaigner* a 144 pp. booklet on the prevention of accidents. The opening article recalls that 34 years ago, in January, 1919, Mr. R. J. Rogers, now Chairman of the Parkinson Stove Co., Ltd., was the speaker at a Birmingham Rotary Club luncheon, and treated a large audience to a most interesting address on a movement new to Birmingham, the 'Safety-First' movement. The Chairman of the Watch Committee, Alderman Alfred Sanders, and the Chief Constable, Mr. Charles Haughton Rafter, were present.

In his address Mr. Rogers divided his remarks into two sections—*viz.*: (1) 'Safety-First' in connection with the saving of life and limb on the public highways; and (2) 'Safety-First' in industrial establishment.

After outlining the measures for road safety adopted by the London 'Safety-First' Council, Mr. Rogers dealt with the street accident position in Birmingham.

He stated: 'The total number of street accidents reported to the police in Birmingham during the two years ended March 31, 1918, amounted to 2,926, the number of persons fatally injured being 119. Total street accidents in Birmingham during 1950, 4,885; 1951, 4,130. The number of persons fatally injured during 1950, 124; 1951, 110.

The following extracts from Mr. Rogers's address indicate his foresight in advocating the formation of a Safety-First Council for Birmingham, and his proposal for the Constitution of the Council.

'A close analysis of statistics show that accidents are due in the main to thoughtlessness, carelessness, and in some cases recklessness. The elimination of these factors can only be effected by educational methods. The exercise of care and caution must everywhere be advocated and indelibly impressed on the minds of the community. Indeed, if a full measure of success is to be achieved the first consideration must be the education of school children.

'No organised Safety-First movement has been carried out in Birmingham. There is ample opportunity and necessity for launching such a scheme in Birmingham. The problem of transport of passengers and materials in Birmingham is an ever growing one. The dangers connected with travelling in the city are not likely to diminish in the near future; on the contrary they will increase.

'In my opinion no time should be lost in the formation of a Safety-First Council for Birmingham. Such a council should comprise representatives of the Watch, Tramways, Lighting and other Committees concerned with the traffic in our streets; members of the Education Committee, representatives of transport organisations, railway companies, private and commercial firms and professional associations, vehicle workers' associations, etc., etc. No better start could be made to interest the local education authorities and their servants with a view to the education of school children with the principles of safety-first.'

In outlining the need for safety measures in industry, Mr. Rogers recommended that such safety duties could with advantage be carried out by works committees on which the management and workers were represented.

In concluding his address he said: 'I appeal most earnestly to you to use your influence in arousing public interest in this important subject. It is a subject which should receive the support of all Rotarians, for I can conceive no better manner of putting into practice the motto of your club "Service not Self" than by helping forward this movement for the prevention of the loss of life and limb of our fellow citizens.'

Among those who took part in the discussion following the address were Mr. Arthur Harrison, President; Alderman Alfred Sanders, Chairman of the Watch Committee; Mr. C. H. Rafter, Chief Constable; Mr. G. O. Restall; and Mr. Norman Tiptaft.

For several years following his address to the Rotary Club, Mr. Rogers endeavoured to obtain the support of the civic authority to the formation of a Safey-First Council, but without success. It was not until 1924 that the first council was formed following a meeting in the Birmingham Council Chamber.

At this meeting Mr. Rogers was appointed to the Council and has remained a member to the present time. In the early years he was responsible for designing essays, drawings and other competitions for the school children, and for some of the special posters issued by the council. He is now a member of the Publicity Sub-Committee of the Accident Prevention Council.

Appeal for More Coal

THE need for reorganisation and co-operation in the coal industry was emphasised at a joint meeting of 2,000 National Coal Board and colliery representatives at Cardiff on February 22. Sir Hubert Houldsworth, Chairman of the National Coal Board, said afterwards that the object had been to encourage the Board and representatives of the National Union of Mineworkers and other unions to get together in the division and consider their own difficulties and, as far as possible, to put them right.

He said that in a frank discussion he had described the serious position of the mining industry and had pointed out the decrease in output. About 3,500,000 tons of coal would be lost by the extra week's holiday and another million tons because of the Coronation holiday. At least 2,500,000 tons more was required for export, and there would be some increase in home consumption. They would thus need at least another 7 mill. tons—an average increase of 150,000 tons a week.

There was, even on last year's output a man-shift, enough man-power to produce an extra 130,000 tons a week, and the question was why they were not getting it. That was the enquiry they wanted to make colliery by colliery.

Sir Will Lawther, President of the National Union of Mineworkers, said that if they failed in this effort now, nationalisation would be a failure.

Mr. Arthur Horner, General Secretary of the Union, who also addressed the conference, said the answer to their problems was to be found in the collieries—not in harder work but in more intelligent work and better organisation. It was the obligation of the Coal Board to make available the means of improving the efficiency of the collieries.

Referring to stoppages, he said: 'I expressed the opinion that we will not tolerate the establishment of extra organisations which set themselves up as counter-leadership to the elected leadership.'

Undertakings Transferred

WHEN the gas industry was nationalised in 1949 a number of undertakings, mainly belonging to holding companies with interests spread over various parts of the country, were not immediately transferred to the gas boards in whose areas they were situated, but became the property of the boards which took over the major operations of the former owners. From time to time Orders have been made under Section 24 of the Gas Act to straighten out the administration of such undertakings.

The Minister of Fuel and Power, after consulting the Gas Council, the South Western Gas Board, and the Southern Gas Board, has now made the Gas (Undertakings of Area Boards) (Transfer) Order, 1953 (Statutory Instrument No. 239), with effect from March 1, transferring the following undertakings:

From the South Western Gas Board to the Southern Gas Board: (1) Gas undertaking carried on by the Devon Gas Association immediately before vesting date in the borough of Lyme Regis and in the parish of Charmouth, both in the county of Dorset, and in the parish of Uplyme in the county of Devon. (2) Gas undertakings carried on by the Devon Gas Association immediately before vesting date in the rural district of Sturminster in the county of Dorset. (3) Gas undertaking carried on by the Devon Gas and Coke Company immediately before vesting date in the rural district of Beaminster in the county of Dorset.

From the Southern Gas Board to the South Western Gas Board: Gas undertaking carried on by the Chipping Norton Gas Light and Coke Company immediately before vesting date in the parish of Moreton-in-Marsh in the county of Gloucester.

In the Journal of February 18 (p. 382) it was stated that the Bridgend undertaking is the largest in the Mid-Glamorgan Group of the Wales Gas Board. In fact the largest undertaking is that of Port Talbot.

DERELICT PLANT RESTARTED

NEWS of developments in the Sunderland and Middlesbrough divisions has been sent to us by the Northern Gas Board. In the former, the increasing demand for gas during 1950, to meet which no additional plant was available, led to the decision to overhaul part of a bench of horizontal retorts at the Hendon works, which had not been operated for 18 years and was considered to be derelict.

The plant, originally constructed in 1901, consists of 12 beds of 'through' horizontal retorts, discharging and charging being effected by pneumatically operated stoking machines. The machines were built by West's Gas Improvement Company in 1903, and subsequently modified in 1919. The plant was finally shut down in 1932 without any apparent attempt at preservation.

The vaults of the house had flooded to a depth of some 2 ft., and in consequence the main flue, recuperators and pier walls showed extensive deterioration below this level. Generally, the brickwork appeared serviceable for a limited period, but the machinery gave cause for doubt after being so many years out of commission.

Overhaul of six beds was commenced in the spring of 1951, the main flue being repaired and most of the recuperators entirely rebuilt; otherwise the retorts, combustion chambers, etc., were merely pointed. It was ultimately decided to retain the compressed air motors, as a preliminary test showed that three of the four motors, after no other attention than lubrication, were serviceable (after 19 years). The original steam operated air compressors were replaced by an electrically driven machine. A reasonable minimum of repairs was effected throughout the plant as it was then anticipated that the settings would only be required for three successive winters.

Gas production commenced in February, 1952, and has continued for 11 months, the plant producing some half million cu. ft. of gas per day. Apart from several initial difficulties the plant has worked well with few mechanical troubles; the pneumatic machinery in particular has been very successful.

Tees-Side Grid

The Tees-side gas grid which now links up the towns of Middlesbrough, Stockton, Hartlepools, South Bank, Redcar, Saltburn and Guisborough, and also the new I.C.I. works at Wilton, is proving itself of inestimable value, and is in considerable use. During periods of high demand, possible deficiencies in pressures in individual undertakings have been avoided and gas has been sent from Middlesbrough to Stockton and also from Stockton to Middlesbrough. Gas has also been supplied from Middlesbrough to South Bank, and during certain periods of shortage, to the Redcar gas undertaking, and since the closure of the Guisborough gasworks that area is being supplied from Redcar.

As an example of the economies resulting from the integration of gas supplies, it is interesting to observe the use which is made of surplus plant by interchange between units and divisions. Following the closing of the Guisborough works, dismantled plant is being transferred to the Darlington division. An additional exhauster required at Redcar is being provided from surplus plant at Darlington, while condensing plant at Skinningrove is being provided from Redcar.

Defective Thermostat Fatality

A DEFECTIVE THERMOSTAT in a central heating boiler caused the death of Sophie Fedorovitch, 50, the Sadler's Wells and Covent Garden stage designer, at her home in Bury Walk, Chelsea, it was stated at the resumed inquest at Hammersmith. Mr. F. C. Smith, a North Thames Gas Board research chemist, said the boiler flame would be extinguished but gas would continue to flow. The coroner recorded a verdict of accidental death.

Mr. Frederick Ashton, Covent Garden Opera House director and producer, said he had warned Miss Fedorovitch about the 'antiquated' heating system in the house.

Angling Club Action

THE HAWICK ANGLING CLUB is to raise an action for compensation against the Scottish Gas Board, which, it says, is responsible for the pollution of a five-mile stretch of the River Teviot. Dr. P. B. Riley, president, announcing this at the club's annual meeting, said: 'A wave of poisonous liquor which flowed into the river from Hawick gasworks last autumn, killed every fish for five miles. The pollution is still going on.'

Last October, Robert Cowie, subgroup manager of the Scottish Gas Board at Hawick, was fined £20 for allowing ammoniacal liquor from the gasworks to flow into the river.

Dr. Riley added: 'Our lawyers have been in correspondence with the Board. So far, there has been no solution. The Anglers' Co-operative Association is interested in our action. One of its representatives, Dr. D. Steven, a lecturer at Edinburgh University, has inspected the river. Fishing in the Teviot this year is definitely finished. I doubt, even now, if there are any trout between Hawick and Denholm worth catching.'

Gas Fires Preferred

A DEBATE on gas fires and central heating resulted in a win for gas fires at a meeting of Aberdeen Health and Welfare Committee on February 10. The debate arose as the result of a suggestion from the Department of Health that central heating should be installed in the old folk's home at Ferryhill Place, Aberdeen.

Councillor May Baird, convener, who moved that the committee should stand by its original decision to use gas fires, said that if central heating was installed a gas fire would also have to be made available. 'You must have something that looks glowing for these old people,' she said.

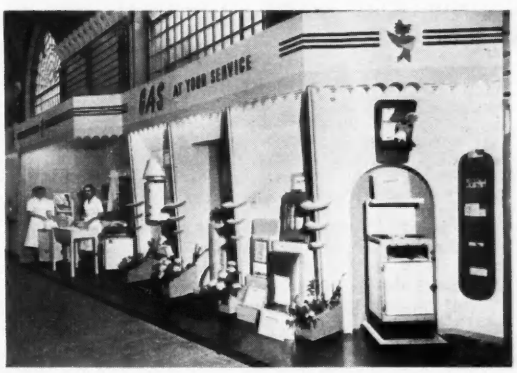
Councillor Morrison agreed that from the point of view of the old people more comfort was to be gained from sitting round a gas fire than a radiator. Councillor Baird stressed that the gas fires would be suitably guarded. Keys to the fires would be operated by the matron only.

Benzole Control to End. — Mr. Geoffrey Lloyd, Minister of Fuel and Power, has announced that he intends to revoke the Order which controls benzole, toluole and naphtha.

The National Coal Board has completed the modernisation of the Bankfoot Coke Works, Crook, Co. Durham. The French coke ovens built in 1882 have been closed, and coke is to be made in Otto ovens which have been rebuilt. About 5,500 tons of coal are carbonised weekly at the works.

BRIGHTON HOME LIFE EXHIBITION

THIS DISPLAY was arranged by the South Eastern Gas Board at the Brighton Home Life Exhibition, held in the Corn Exchange from January 21-31. Home service advisers gave cooking, home laundry, and refrigeration demonstrations in the model kitchen, and the rest of the display showed a range of gas appliances and a 'live' gas-ignited solid fuel fire. Cookers were interchanged on the stand during the period of the exhibition. The two home service advisers shown in the photographs are Miss Betty Andrew and Miss Yolande Leeson. The stand was colourful and well lighted and was well patronised by visitors to the Exhibition.



C

IN PARLIAMENT

Qualifications of Board Chairmen

THE appointment of the new Chairman of the Southern Gas Board (Mr. A. R. McBain, C.B., C.B.E.) was the subject of a Question in the Commons on February 16, when Mr. R. F. CROUCH (Dorset, North) asked the Minister of Fuel and Power how he interpreted the statutory qualifications required for the appointment of chairmen and deputy-chairmen of gas boards. Was the newly-appointed Chairman of the Southern Gas Board a qualified gas engineer.

Mr. GEOFFREY LLOYD stated that the qualifications were clearly defined in the Gas Act, 1948, which laid down that of these board members one should be an engineer. It was left to the Minister administratively to decide whether the other should not be someone with general administrative experience.

Mr. CROUCH asked if it would not be wiser to have a qualified gas engineer at the head of affairs. Surely his right hon. Friend did not suggest following the example of the previous Government of creating 'jobs for the boys?'

'No, Sir,' replied the MINISTER. 'I think that qualified gas engineers are most important in the organisation, and the Act lays down the procedure, I think correctly. General administrative experience is most important, and was, of course, one of the qualifications in the successful gas companies in pre-nationalisation days.'

Mr. H. HYND (Accrington) suggested that it was not the custom in commercial undertakings to have technicians as members of the board.

On being asked by Mr. F. BESWICK (Uxbridge) to express his disagreement with the implied criticism that the present Chairman had not the necessary qualifications, Mr. LLOYD replied: 'Yes, Sir. The present Chairman has my full confidence.'

This 'Lethal' Gas

A curious Question by Mr. A. ROBERTS (Normanton) asked the Minister whether he was aware of the high carbon monoxide content in gas supplied in this country, which made escapes of gas difficult to detect. Would the Minister make regulations to ensure that gas shall have a more characteristic smell in order to protect the public from the danger of unknowingly inhaling it?

On being informed by Mr. LLOYD that the law already provides that gas must have a distinctive smell, Mr. ROBERTS followed up with an even more curious Question: "Is the Minister aware,' he asked, 'that the sole occupant of an *all-electric* house' (the italics are ours) 'was gassed with fatal results on November 26 last?' This looks like presenting a pretty problem to electricity undertakings, since the gassing of occupants of all-electric houses is a hazard to which they have hitherto probably given little serious thought. But this was not the end of Mr. Roberts' intervention. He went on to recall that the vicar of the parish in which the fatality occurred turned himself into a guineapig and 'sealed a room in his own house and read a book without detecting the gas.' (Perhaps there wasn't any gas there.) Was the Minister also aware, pursued Mr. Roberts, that the gas supply in his own district contained 15% carbon monoxide, which was lethal?

The vicar turned himself into a guinea-pig and sealed a room in his own house and read a book without detecting the gas.

Mr. LLOYD admitted that he was aware of the lethal qualities of gas which had so shocked the hon. Member for Normanton. All gas supplied by gas boards, he observed, had a concentration of carbon monoxide above the lethal level—which was the reason for providing that it must have a distinctive smell.

Brigadier O. L. PRIOR-PALMER (Worthing) was exercised at the number of accidents in caravans and boats from butane or bottled gas and asked the Minister whether the statutory obligations he mentioned also applied to this gas. Mr. LLOYD was not prepared to commit himself on this point and said he would like to look into it.

Electrical Heat Storage

Considerable interest has been aroused by the development of electrical heat storage devices whereby current can be taken at off-peak periods. Mr. PHILIPS PRICE (Gloucestershire, West) was, we think, guilty of a small technical inaccuracy when he referred to 'devices for storing electricity,' but the purpose of his Question was to ask the Minister of Fuel and Power whether he would give a general direction to the B.E.A. to arrange for the revision of tariffs to encourage the greater use of such devices.

Mr. LLOYD commented that there was no occasion for a general direction, but he was discussing with the B.E.A. whether alterations in general tariff policy could give further encouragement to off-peak consumption. He believed the method referred to by Mr. Price was a very promising one. (Readers will find reference to this heat storage system on p. 329 of the *Journal* of February 11.)

Incorporated Plant Engineers

First Annual Dinner

THE FIRST ANNUAL DINNER of Incorporated Plant Engineers was held at the Café Royal, London, on January 30, and was attended by approximately 150 members and guests. Among the guests were Sir John Maud, K.C.B., C.B.E., Permanent Secretary, Ministry of Fuel and Power, Sir Norman Kipping, J.P., Director General, Federation of British Industries, Mr. W. L. Boon, O.B.E., Powell Duffryn Technical Services, Mr. R. M. Wynne-Edwards, D.S.O., O.B.E., M.I.C.E., a Council Member of the Institution of Civil Engineers and the Guild of Engineers, and Mr. A. Clifford-Hartley, C.B.E., F.C.G.I., B.SC., Past-president, Institution of Mechanical Engineers.

Sir John Maud, proposing the toast of the Institution, said that he was in no doubt as to the importance of plant engineers and that his Department regarded them as allies in the common effort to conserve our resources. He believed the Institution to be one of literally national importance because it helped the 'front-line troops' of fuel utilisation to do a still better job each year. It raised standards and through its 18 branches (representing a membership of nearly 3,000) exchanged ideas, and such exchange was the beginning of all wisdom and all research.

Responding, the President, Mr. G. A. Rooley, A.M.I.MECH.E., F.INST.F., thanked Sir John Maud for extending the hand of friendship from his Ministry, and assured him that plant engineers would do all in their power to help him if called upon to do so. Tracing the growth of the Institution from its inception less than seven years ago, he felt certain that the future would see it going from strength to strength.

ACCURATE DETERMINATION OF Specific Gravity of Town Gas

By J. R. KENWARD,
Gas Standards Officer,
and
T. A. LUCAS, B.Sc., A.R.C.S., A.Inst.P.,
Central Laboratories, South Eastern Gas Board.

ATTENTION has in recent years been focused upon the Wobbe Index, $\frac{C.V.}{\sqrt{S.G.}}$, as offering a simple means of control of the thermal input to existing appliances. In order accurately to determine the Wobbe Index, it is necessary to know both the calorific value and the specific gravity of the gas. Methods are available, using the

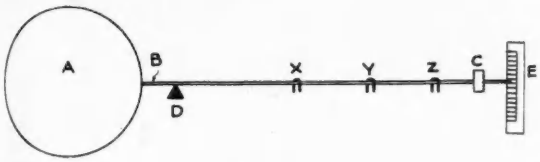


Fig. 1

Boys non-recording equipment, or recording calorimeters, for the accurate determination of the calorific value while recorders are available for measuring the specific gravity with comparable accuracy.

There are, however, many cases in which a 'spot reading' of specific gravity would be useful, but unfortunately no completely satisfactory instrument has been available for this purpose.

Methods of measuring specific gravity which have been used are:—

(a) Those based on the relative rates of effusion of air and gas. Instruments based on this principle have proved to be somewhat unreliable due to viscosity and solubility effects.

(b) Measurement by means of micro-manometers of the differential pressure set up between columns of air and gas. This system does not provide portable apparatus and requires a skilled operator.

(c) Direct weighing which gives the most accurate results but can be carried out successfully only by a skilled operator in a laboratory.

(d) Indirect weighing using Archimedes' principle. This is the basis of the specific gravity balance devised by J. S. Hales and W. C. Moss at the Fuel Research Station, Greenwich.*

Method (d), from many points of view, is the most satisfactory. It is suitable for use with any gas or gas mixture, only small quantities of the sample being needed. The time taken to perform a test is very short, and the instrument lends itself to a design in a portable form.

In its early form the instrument was constructed largely of glass and this was felt to be unsatisfactory when works use was considered. A recent pattern produced by an instrument manufacturer would certainly fulfil the needs of a research laboratory. Glassware has been completely eliminated, but the design renders it more suitable for laboratory than for works use.

On further consideration it was decided that there was a need for an instrument of the Hales and Moss type designed specifically for use on a gasworks, with the measurement of coal gas specific gravities as its main function and with particular emphasis on robustness and portability. Such an instrument has been developed and forms the subject of this note.

In designing this form of balance, the theory and operating principles of the instrument are unchanged. They are dealt with at some length in the paper 'A Gas Specific Gravity Balance,' already quoted. It will be convenient, however, to give here a brief description of the operating principles though the main emphasis is placed on the constructional differences which exist between this instrument and the original.

As in the original instrument, the basic principle is that a chamber is provided in which a sealed sphere can be surrounded successively by air and by the gas under test, the difference in buoyant upthrust on the sphere under the two distinct conditions being a measure of the specific gravity of the gas (Fig. 1). The instrument is designed to measure this difference. A sealed metal sphere, A, is fixed to the short end of a beam, B, which carries an adjustable counterweight, C. The beam pivots about an agate, D, and in addition to the counter-weight three riders, X, Y, Z, are provided on the balance arm; two riders are used to determine the specific gravity, while the third has as its function only the initial balancing of the beam in air. A scale, E, indicates the beam position. In practice the beam is made in two sections, the lower being used only for the air rider. The upper section is calibrated and carries the gas rider. Gas is admitted through a tube containing calcium chloride, and a change-over

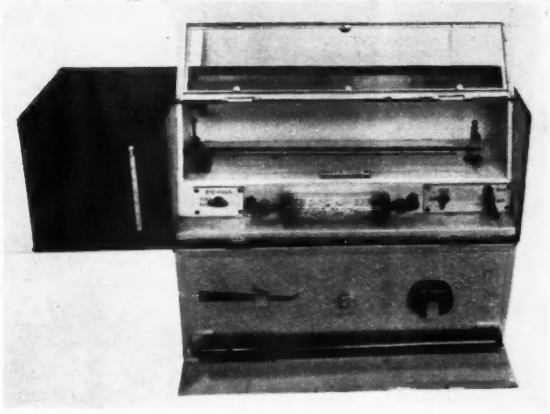


Fig. 2

cock provides for a high rate of gas flow to sweep out the chamber and a small but positive gas flow to prevent air diffusing into the chamber while the test is being made. A hand pump is provided for sweeping the chamber clear of gas before balancing with air. It was felt that a practical difficulty might arise if the rider weights became lost or damaged. Accordingly, the values of these weights are engraved on a label which is screwed to the case so

*'A Gas Specific Gravity Balance' by J. S. Hales and W. C. Moss, *J. Sci. Instrum.*, 1935, vol. 12, 309-13.

that repair or replacement can be easily carried out. For transport a simple fixing device is provided which raises the beam clear of its agate.

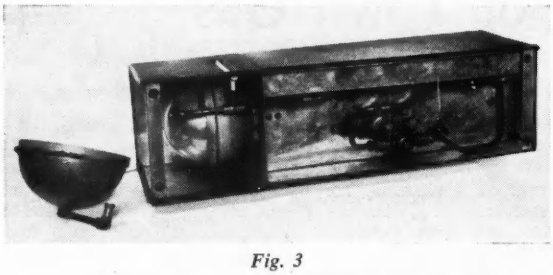


Fig. 3

Since the apparatus has been designed chiefly for testing the specific gravity of coal gas, certain simplifications have been possible. No provision has been made for temperature compensation since it has been found that under working conditions, with a temperature change of 20°F., an error less than 0.001 will arise. No attempt has been made to make the air weight a compensator for tabular number variations; neither is provision made for the measurement of gases whose specific gravity is greater than 1. It has been assumed that the main use of the balance will be the measurement of the specific gravity of town gas and that sufficient gas will be available to supply gas at the rate of 3 cu.ft. per hour although the volume in any test need not exceed 1/10th cu.ft. It has, therefore, been possible to increase the interspace between the sphere and its container. This reduces the chances of fouling between the sphere and simplifies the construction of the instrument.

Since it was desirable to make a balance of adequate sensitivity which would stand a certain amount of rough usage, it was essential that the operating thrust should be as large as possible. In order to achieve this the volume of the sphere itself must be large as compared with its weight. The sphere diameter was therefore increased and, in order to reduce the weight, the sphere was made of aluminium, the wall thickness being reduced as far as possible. In fact by using a 4-in. diameter ball of 24 gauge aluminium, spun in two halves, it has been possible to obtain the necessary sensitivity with an instrument which is robust and portable. This construction also considerably facilitates the assembly of the instrument. To prevent gas leakage into the inner sphere the joint between

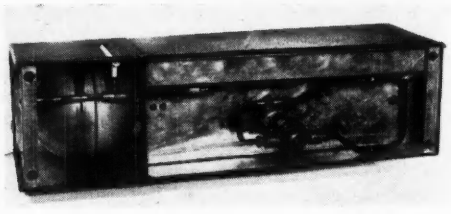


Fig. 4

the two halves is sealed before assembly is completed. The outside of the sphere is coated with lacquer in order to prevent chemical attack. Either leakage or chemical attack would lead to an incorrect determination of the specific gravity.

The finished instrument is shown in the accompanying photographs. Fig. 2 shows the instrument with the case open ready for use. It can be noted that all necessary equipment, the tweezers, the pump, and the container for

(*Concluded on page 448*)

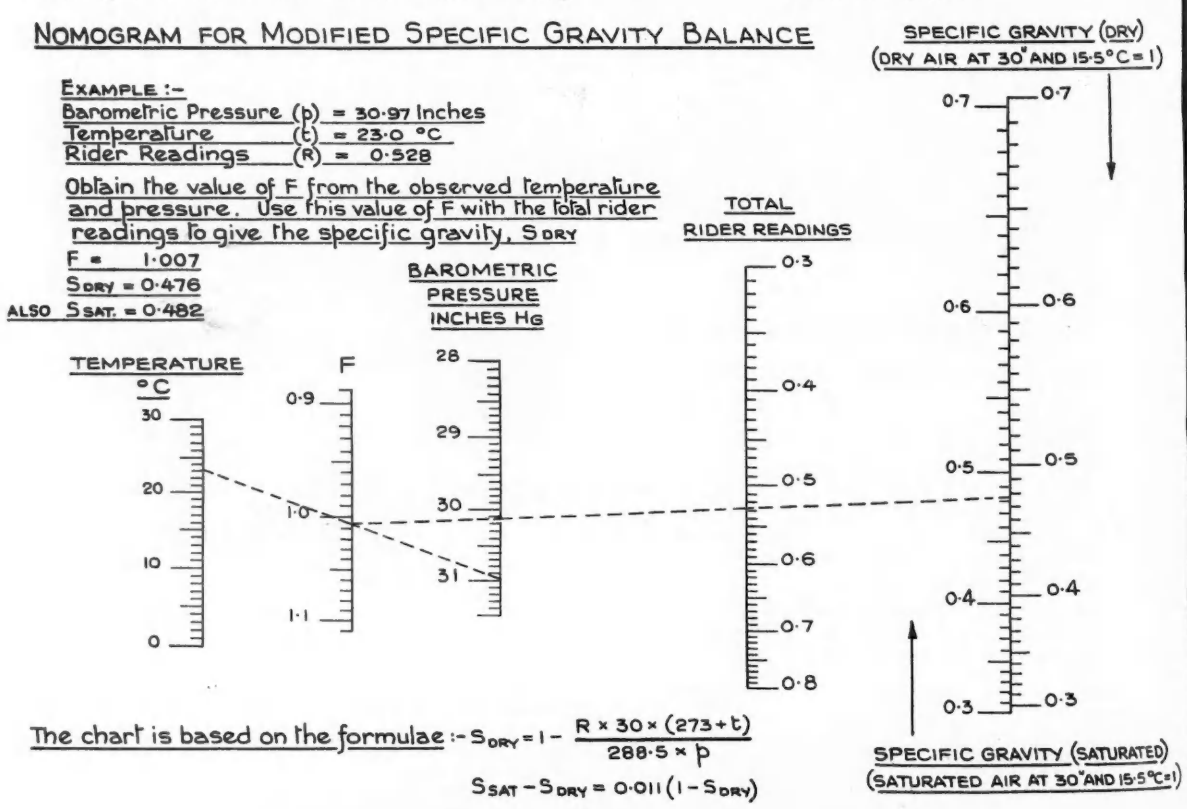


Fig. 5

WELDED ALUMINIUM COKE SKIPS

A COKE skip travelling on a telpher line conveying hot wet coke from a retort house to a loading dock is obviously subject to severe abrasion and corrosion. It is also heavy and requires considerable human and mechanical effort when it is being handled.

At the Linacre works of the Liverpool Group, North Western Gas Board, these skips have hitherto been made of steel. Recently in an effort to secure a better return for expenditure it was decided to make some skips of an aluminium alloy in order to take advantage of the light weight and corrosion-resisting properties of this material.

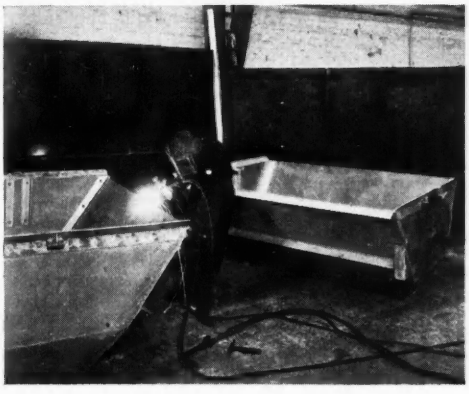


Fig. 1. Welding in progress on the skips.

The latest issue of the *Welder*, published by Murex Welding Processes, Ltd., Waltham Cross, Herts, describing the skips, says it will be appreciated that a lighter skip requires less effort in handling and consequently produces an increased payload and, if made of a suitable aluminium alloy, it should have a longer life than a steel skip, bearing in mind that corrosion in this application is possibly more severe than wear.

Fig. 1 shows welding in progress on some of these aluminium skips, which were designed and made by the construction and maintenance department of the group. They are fabricated from an aluminium alloy known as 'Kynal' M 39/2 supplied by I.C.I. (Metals Division), and all the welding was carried out with Murex plain extruded aluminium—5% silicon electrodes, practical experiments first being carried out to produce the deep penetration required at the junction of the ends, sides and angles. A Murex diesel engine driven set gave the necessary fine current regulation for the welding and a Murex service engineer gave advice and assistance in the initial stages.

The main body of each skip was made of ¼ in. thick plate reinforced along the edges with extruded 3 in. × 3 in. × ¼ in. angle sections. The shell of each skip was completely assembled, using temporary ⅜ in. bolts at about a foot apart. The welding was then carried out under a gantry so that all the joints could be welded in the downhand position. When the seams were completed the bolts were removed and all the holes were filled with weld metal.

It was obviously inadvisable to use aluminium trunnions for the lifting hooks, and these were therefore made of steel and bolted to the aluminium shell, using 'Alkathene' as an insulating material. This material is an I.C.I. plastic sheet 0.01 in. thick, and in this case it was used to offset any electrolytic action between the two dissimilar metals. It was accordingly carefully inserted between the steel and the aluminium, including the bolts and washers.

Fig. 2 shows a completed skip, and its dimensions are 6 ft. 11 in. × 5 ft. 2 in. at the top and 5 ft. 11 in. × 1 ft. 1 in. at the bottom. Its capacity is approximately 15 cwt. of coke and it weighs approximately 4¾ cwt. A steel skip of similar capacity weighs about 11½ cwt.

The skips are now in service and a close check on their performance is being kept. It is anticipated that over an extended period the weight advantage alone will counterbalance the increased cost of their construction. It has been found that the average payload has been increased by about 25% without necessitating any increase in the safe working load of the telpher machines which operate the lift.

The production of these new skips represents a very progressive outlook, says the *Welder*, and they will no doubt prove of considerable interest to many other engineers dealing with similar applications.

The foregoing description in the *Welder* has prompted us to seek further information on this development in the use of aluminium alloy, and we are able to supplement the experience recently gained at Liverpool by work carried out several years ago at Bristol. Development work undertaken shortly after the end of the last war by Mr. L. A. Ross, Station Engineer of the Stapleton Road, Bristol, works of the South Western Gas Board, is added to make our article on this interesting subject complete.

Mr. Ross explains that during the last war it became evident at the Stapleton Road works of the former Bristol Gas Company, now Bristol Sub-Division, South Western Gas Board, that modernisation of the system of coke handling from a 6 mill. cu. ft. per day vertical retort house was urgently required. Unfortunately, the layout of the house did not lend itself to the installation of conveyors, and it was therefore decided to adopt electric battery-operated trucks, chosen for simplicity of handling and easy manœuvrability. For obvious reasons it was desirable to use the maximum possible capacity of skip (handled by the truck to an existing 2-ton overhead gantry crane), and thoughts naturally turned to the possibility of using welded aluminium skips which would be more corrosion resisting than the steel skips previously used, and, being only 35% of the weight of a steel skip, would enable an 18 cwt. pay load to be carried without overloading the truck.

Accordingly, the skip was designed by the works staff and fabricated from James Boot & Co.'s non-heat treated DTD. 606, half hard, MG5, ¼ in. aluminium alloy plate, standard non-extruded aluminium—5% silicon rods made by Murex Welding Processes, Ltd., being used in conjunction with a motor generator of Murex manufacture for the welding operations. Early weld failures due to the use of fillet welding led to Murex being consulted. The firm recommended the adoption

Fig. 2. A completed aluminium skip.

of butt welding at all corners. A skip was fabricated with flanged end plates to give only one butt weld per corner. This skip was completely successful, though to eliminate the lengthy flanging operation skips are now built with a skeleton framing of 1 in. × 1 in. × ¼ in. aluminium alloy angle—side, end, and bottom plates being butt welded into position. The latest aluminium—5% silicon extruded rods since marketed by Murex have been adopted, and give a much improved weld as compared with the old rods.

Similar work has been carried out in the North, where an insulating material is being inserted between the steel trunnion plate and the skip side to prevent electrolytic corrosion. It is

probable that this improvement will be adopted at Bristol, though electrolytic corrosion at these points has not been severe. It is of interest, however, that corrosion has been observed adjacent to some welds, though it has not yet been possible to ascertain whether this corrosion is electrolytic in character due to dissimilar alloy characteristics of the corner angle as compared with the plate, or whether it is due to stress corrosion.

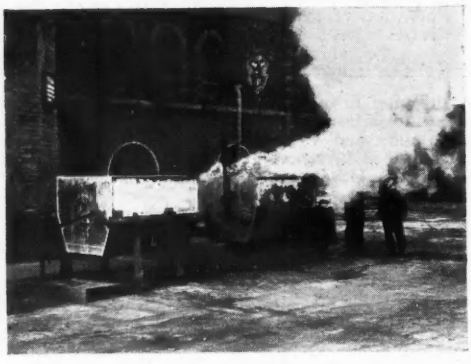


Fig. 3.—Welded Aluminium Coke Skip at the Stapleton Road Works, Bristol.

The skips have a life of approximately 50,000 tons of coke and have proved so satisfactory that a telpher skip of identical design has been adopted at the horizontal retort house, with a pay-load of 23 cwt.

Smaller telpher skips of similar design, with a pay-load capacity of one ton, have also been in use for four years handling oxide of iron used in connection with gas purification, where very rapid corrosion took place with the steel skips formerly used.

SPECIFIC GRAVITY DETERMINATION—

Concluded from p. 446

the weights, are mounted in the lid so that the instrument is self-contained. Fig. 3 shows the construction of the instrument, the outer sphere having been opened and the inner sphere being visible. The re-assembly of the outer sphere is a simple matter, the joint being a standard union.

Fig. 4 shows the assembly underneath the instrument including the governor which is used to control the gas inlet pressure.

The overall dimensions of the instrument when it is closed for transport are approximately 18 in. × 6 in. × 6 in. making it easily portable.

When the balance is used, the most important point to be observed is that constant readings must be obtained on both the air and gas tests. Initially the pump is connected and after adjustment of the cocks the interspace between the spheres is swept out with air. The beam is balanced by means of the air rider and further pumping is carried out until the position of balance remains unchanged. The gas is turned on and the gas riders are used to re-balance the beam after the cock has been turned to the slow gas rate position. Gas is passed until constant results are obtained. The gas temperature is read on a thermometer which forms an integral part of the apparatus and the barometric pressure is also noted. A nomograph is provided (Fig. 5) which enables the specific gravity to be read off direct. The balance records specific gravity of dry gas relative to dry air, but if it is desired to obtain the specific gravity of saturated gas the nomograph can be used with equal facility.

The modified instrument as compared with the original is much more robust while glassware has been completely eliminated except for the drying tube.

The error obtained with this instrument is of the order of ±0.001. The procedure adopted for calibration has been the production of one standard instrument which has been calibrated against gases of known density, and further balances produced are calibrated against this standard instrument. The standard itself is re-calibrated at intervals.

[*This note is published by permission of the South Eastern Gas Board.*]

FIREGUARDS FOR HEATING APPLIANCES

IN order to assist the implementation of regulations to be issued by the Home Office under the Heating Appliances (Fireguards) Act, the British Standards Institution has issued a new specification for fireguards for heating appliances.

This specification brings together the requirements for guards for gas, electric, and oil-burning heaters, as prescribed in B.S. 1250, Part 2: 1946 (Amendment No. 1) for gas fires, B.S. 1670: 1951 for electric fires, and in a specification at present in course of preparation for kerosene (paraffin) appliances for domestic use.

The requirements in this new specification (B.S. 1945: 1953) are, in general, technically similar to those relating to guards in the three specifications, but editorial modifications have been made in order to present the requirements in a more convenient way.

Furthermore, a departure from B.S. 1250, Part 2: 1946 (Amendment No. 1) has been made in that, according to that document, guards are required to be attached only to portable gas fires and gas fires fitted above hearth level, while fires intended to be fitted into a hearth are required only to have provision for the fitting of a guard. In the present British Standard all gas fires, whether portable or fixed, used for domestic purposes and the like are required to be guarded. This extension of B.S. 1250, Part 2: 1946, has been made in order to bring the present British Standard into line with the regulations which will shortly be issued by the Home Office under the Heating Appliances (Fireguards) Act, 1952.

This new secification applies to all types of gas fires, electric fires, and oil-burning heaters, whether portable or fixed, used for domestic purposes and the like and having heating elements, exposed flames, or radiants of such a nature, or so positioned that there would be the risk of fire or injury from burns resulting from clothing, textile fabrics, and the like making contact with, or being in proximity to, such heating elements, exposed flames, or radiants, if guards were not fitted.

The design of the guards is determined by compliance with a test designed to control the sizes of openings in the guard. The effectiveness of the guard is also determined by means of a scorching test, in which a piece of flannelette of specified quality is placed in contact with the guard. The flannelette must not smoulder or ignite within a specified time. A test for the mechanical strength of the guard is also included.

Heating appliances provided with guards in accordance with this new specification are required to be marked with the words 'Guarded in accordance with B.S. 1945.'

Copies of this standard may be obtained from the British Standards Institution, Sales Branch, 24, Victoria Street, London, S.W.1. Price 2s.

WETTING OF BOILER SLACK

IT has long been known that the addition of water to boiler slack improves combustion. At first sight, such treatment would appear to be likely to impair boiler efficiency, because the added water must be evaporated, but the effect is only about 0.1% for each 1% of added water. On the other hand, the improvement in combustion efficiency can be very marked, CO_2 content being increased, flue-gas temperature reduced, grit emission diminished, and output raised.

To explain the principles of conditioning and describe its effects, the Ministry of Fuel and Power has produced Fuel Efficiency Bulletin No. 53 (Stationery Office, 6d.). Entitled 'The Wetting of Slack to Assist Combustion,' it deals with the mechanism of slack conditioning, gives evidence of the beneficial effects, and describes the limits of application and practical methods. Under test conditions, boiler efficiency has been known to rise from 54% to 74% by the use of these methods.

Water Supply and Works Reconstruction

By C. STOTT, M.C., B.Sc., M.I.Chem.E., M.Inst.Gas E.,
Deputy Chief Engineer,
and B. C. HINWOOD, M.Inst.Gas E.,
Engineer, East Greenwich Works, South Eastern Gas Board.

From a paper to the London and Southern Section of the Institution of Gas Engineers

THE existing cooling water system at East Greenwich centres round the reservoir formed by the conversion of the old Blackwall Dock for the purpose. Penstocks to the river are opened when the tide rises to the level of the stored water and are closed at high water. The water thus impounded passes through decantation bays to the final storage bay and thence flows by gravity through two 36 in. mains to open pump sumps at suitable points on the works. This scheme has operated from 1929 and though the settlement of mud by decantation at the reservoir is only partially effective, the mud carried forward has not affected continuity of process by blockage of river water mains and services; nor has corrosion in gas coolers or steam condensers been unduly high. This system served the works for all cooling and condensing purposes, coke quenching, fire hydrants, etc., and includes a return main carrying outlet water from the gas cooling system to the reservoir, the water passing through rack coolers before entering the return main.

It is intended that this reservoir system should continue to supply the section of the works based on the old horizontal retort plant.

Cooling Water Requirements

Provision has been made for the installation of eight coke oven batteries of 22 ovens each. This unit size fits in best with the proposed schedule of battery renewal, and the units can be conveniently grouped for economic working and manning. Two batteries formed the initial stage, a third battery is approaching completion and the further batteries will be added as planned to complete the scheme in ten years, giving a final output of 48 mill. cu.ft. a day of coal gas at 540/550 B.Th.U.

C.W.G. plant to produce a total of 24 mill. cu.ft. a day in eight units has been planned. Four units are at work, and the installation of a further two units is proceeding as an intermediate stage.

Wet purification plant of 30 mill. cu.ft. of coal gas per day capacity and comprising primary coolers, turbo exhausters, secondary coolers, electrostatic detarrers, and ammonia washers is installed and provision is being made for extension as required. On oxide purification, a new 12 mill. cu.ft. a day stream of tower purifiers is at work and its early duplication is in hand.

The new extensions make the maximum use of electric drive and a power house has been built to generate 6,500 kW at 6,600 volts. The supply at this voltage is fed to the works through inner and outer ring mains to six sub-stations. Two turbo-alternators each of 2,000 kW capacity, are available, though the present load is within the capacity of one unit, a third unit is in process of installation.

The cooling water requirements of the items of plant had been carefully evaluated when the specification and design of the various units were prepared. A tabulation of the cooling water users considered in conjunction with the programme of plant extension, enables the water requirements to be determined at each stage of development.

Early consideration was given to the possibility of adapting the existing river intake system at Blackwall Dock to meet the new requirement. The capacity of this reservoir, conditioned as it is by tidal levels and variations and by the loss of storage involved in the decantation system, limits the flow to the works of 'first-run' water to no more than 75,000 gal. an hour. This flow can be increased if cooling effluent is returned to the reservoir, but if a rise in temperature of the water so circulated is to be avoided, a major water cooling system would have to be interposed in the return line. As the volumes of old and new requirements were so widely divergent and the work of modification of such a major nature, it was decided that the solution was not to be found here—yet another example of the failure which inevitably attends the attempted adaptation of existing out-dated facilities to the requirements of the new.

A further factor is concerned with the accepted proposal to duplicate Blackwall Tunnel. The route of this second tunnel will pass beneath the reservoir and the effects of the construction on its stability have been questioned. In these circumstances it would not be prudent to contemplate major work associated with a key process in this area.

The issue now lay between the use of river water direct or the adoption of a water cooling and re-circulating system chosen from the various forms employing natural or forced draught. At the time of this decision it was considered that the overall cost of water from a re-circulation system would not fall far short of 3d. per 1,000 gal., whereas for a river water pumping system the comparable cost would be about 2d. Further, 20 years' experience in the use of river water for cooling and condensing purposes showed that this method was unlikely to involve undue corrosion hazards or prejudice continuity of supply; nor had the prevailing river temperatures adversely affected process control.

Facilities were available for a wide study of power station practice at comparable sites on the river, and it was confirmed that in such cases direct pumping had been adopted as standard procedure.

Problem of Mud Entrainment

The problem of mud entrainment in river water systems was appreciated and its extent and variation were assessed. Various research authorities were consulted in an attempt to establish for Thames conditions a relation between water velocity and silt deposition, but they were unable to provide the information required. Figures available for the Mersey and results obtained in comparable practice indicated that sedimentation becomes pronounced when the flow in the system falls to 2 ft. per second, becoming negligible at rates of 5 ft. per second.

The use of Thames water in cooling water systems is further prejudiced by the wide seasonable variations in water temperature and by the progressive rise in the level of river temperatures due to its increasing use over recent years for cooling purposes. The mean temperature of the Thames at Greenwich has risen by about 5°F. over the last 20 years.

The ground area required for natural draught water coolers is very considerable, and it was difficult at this stage of works development to allot a suitable site; we were unwilling to occupy land which might be put to better use in later years. The discharge of moisture into the atmosphere from cooling towers was considered to be an adverse factor as atmospheric

corrosion is already a considerable problem in this area of London.

After full consideration of these aspects, the decision was taken to adopt a river water pumping scheme to provide a main cooling system serving the new developments.

The first discussions on the general problem of cooling water supply took place on September 10, 1946, and the scheme now described went to work on July 3, 1950.

The pump house occupies a convenient site on the wharf-side and is approximately on the cross centre line of the works extensions. A natural continuation of this line gave a general location for the river water intake works in an acceptable area downstream of the lower coal jetty dolphin.

The Port regulations do not allow river works to be undertaken beyond the line of the jetty. The over-riding consideration at the intake is that the sill of the intake chamber should be covered under conditions of the lowest recorded tide. The tidal conditions provide the basic data for the scheme design and are summarised below:

Statutory flood protection level	+17.00 N.D.
Highest recorded tide	+16.74 N.D.
Mean high water spring tides	+11.74 N.D.
Mean high water neap tides	+ 7.90 N.D.
Mean low water neap tides	− 6.05 N.D.
Mean low water spring tides	− 9.10 N.D.
Lowest recorded tide	−13.60 N.D.

In order to establish stable conditions relative to the tidal movement of mud on the river bed in the intake area, it was decided to make the dredge level at this locality −16.8 N.D. This is conveniently the same level as that of the berth at the face of the jetty. The dredge level is 1 ft. below the sill of the intake chamber which gives a cover of 2 ft. above the chamber grid under conditions of the lowest recorded tide. The permanent protection work above the intake chamber is formed by eight 66 ft. long No. 4 section Larssen box piles, surmounted by a heavy reinforced concrete capping 5 ft. deep. The box piles were each filled with 2¼ tons of 1½ in. tarred granite. The four sides forming the perimeter of this dolphin are covered with galvanised woven metal screens of $1\frac{3}{16}$ in. mesh, running from the sill of the intake chamber at −15.80 N.D. to a height of +18.00 N.D. to prevent the intake of flotsam. These screens are made up in frames to form panels of reasonable size to facilitate removal and maintenance. To provide access for this operation, three platforms of R.S. channel section are welded to the inside of the box piles supporting a decking of 3 in. timbers. Three galvanised steel ladders give access to these platforms.

Intake Chamber

The intake chamber is constructed in reinforced concrete in the river bed within a coffer dam of sheet piling. It is formed in two compartments, one serving each intake main. The compartments are thus separated in order to avoid the danger of the silt ejected at this point by back-flushing being drawn in at the adjacent intake. The area of the horizontal openings to the intake chamber is 25 sq. ft. measured clear of the screen bars and supporting beams. These openings are protected by galvanised screens, consisting of ½ in. diameter bars welded at 3 in. centres each way.

The twin intake mains are C.I. socket and spigot pipes, 30 in. inside diameter, laid in the river bed with the fall of 1 in 50 towards the intake chamber, and are surrounded by concrete having a minimum thickness of 9 in. above and below the mains. They can be closed at the outlets of the intake chambers by means of penstocks operating from the capping level at the intake dolphin. The mains discharge into two pump suction wells or into the flushing chamber through 30 in. penstocks.

The intake main was originally envisaged as a single main of 42 in. diameter; but in the earlier years of development the reduced water requirement would have involved low rates of flow in the order of 1¼ ft. per second, with consequent heavy sedimentation. This led to the adoption of twin mains providing for the employment of one main in the initial and intermediate stages with flow rates under minimum take conditions of 2¾ ft. per second. This arrangement permits the alternate use of these mains for the main supply. At the pump house end they are connected through penstocks to a flushing chamber in which water can be impounded at high tide. If the water thus stored is released into the idle main at low tide, an effective back flushing of the mains and its section of the intake chamber is effected. The discharge of the flushing chamber by this procedure gives a reversed flow at 20 ft. per second, and 15 ft. per second under spring and neap tide conditions respectively. A raised division wall, 4 ft. high, between the intake chambers, prevents the ingress of the flushings to the working chamber.

Pumping Station

The structural design of the pumping station is of interest and has unusual features. Borings showed 20 ft. of sandy ballast lying 31 ft. below the surface and overlaying firm blue clay. Analysis of the ground water indicated that the sulphate content was sufficiently low to justify the use of portland cement.

The excavation to 45 ft. below ground level was carried out within a 61 ft. diameter ring of No. 3 Larssen steel sheet piling. To reduce ground water during construction, the piles used were 60 ft. long in order to reach and penetrate the clay. In pitching the piles, 60 ft. and 30 ft. lengths were pitched alternately but, before driving, a second 30 ft. length was butt-welded to the short length. The piles were driven in successive stages, the whole ring being driven 15 ft. at each stage. Beyond 45 ft., driving became very difficult and it was frequently necessary to burn off the top of the piles to clear the hammer legs. It is doubtful whether in all instances, the required penetration into the blue clay was realised.

Cross bracing of the coffer dam was avoided by constructing reinforced concrete ring beams at +8, +0.5, −6.0, −10.5, −16.5 and −22.5 (all levels N.D.) against the sheet piling. Excavation was carried down successively to each of these levels and the beam cast and cured before excavating to the next level. It is interesting to note that the strata agreed to within 3 in. of the levels obtained from the trial borings.

During excavation water was always present, but by sinking a sump well ahead of the excavation, a 4 in. diameter centrifugal pump was sufficient to keep the bottom dry. The sheet piling ring showed some discrepancies from true circle, but these were made good by varing the width of the ring beams to give a face circle true to practical limits. Soffit and back shuttering at outpan positions was carried by close mesh fabric welded to the sheet piling.

When bottom was reached seven sumps having standpipes interconnected with water levelling pipes were laid, and the floor was given a 6 in. blinding layer of high alumina cement concrete. A coat of tar was sprayed on to the top of the blinding, and covered with loose shingle.

At this stage, the 4 in. self-priming pump was kept in continuous use and a permanent watch kept on the water level in the sumps. A reserve pump was placed in position in case of breakdown and a further pump maintained to flood the base should a dangerous rise in hydraulic head be indicated in the sumps.

The 4 ft. thick floor slab was cast in seven parts, each part embracing a sump. At least three days curing time was allowed before placing concrete in an adjacent section. The whole floor was cast in 10 days.

In principle the walls were cast in 4 ft. lifts with slight variation in the first lift to allow for casting in the 30 in. diameter cast-iron pipes. The reinforcement in the external 30 in. wall was reduced to nominal requirements as the wall was cast monolithically with the ring beams. It was necessary from design considerations that pumping from the standpipes continued until all the internal walls were at least 10 ft. high,

and the sumps in the floor were not actually sealed until the concreting of the pump house had been completed.

The pump house basement houses the pumps, the suction wells and the flushing chamber. The pumps draw from the wells through bell mouthed suction pipes; the bell mouth looking downwards in order that the depth of water over the highest point of the lip shall not be less than 4½ ft. at the minimum low tide. This eliminates the possibility of vortex action and entrainment of air under maximum flow conditions. The pumps and the suction pipes are flooded at all states of the tide.

The pump control room, superimposed on the pump house standing just above ground level at +20 N.D., houses the motors driving the pumps and the rotary strainers on the delivery mains together with the penstocks controlling the admission of water to the suction wells and flushing chamber.

A battery of three vertical spindle centrifugal slow speed pumps will be served by each of two pumping chambers. The twin delivery mains are each provided with a rotary strainer, and the outlet to the system is designed to feed twin 30 in. diameter supply mains to the works, the first of which is at work. The pumps are driven from the control room by totally enclosed compound wound d.c. motors of 125 h.p. designed for automatic speed variation by shunt control. The discharge branch of each pump is fitted with a reflex valve.

The 'Deptford' rotary water strainer is designed to remove all debris and major solid particles passing the coarse screens at the intake. It consists of a perforated gunmetal drum mounted on spiders, which rotates within the cast-iron body. The water is delivered by the pumps to the outside of the drum, passes through the $\frac{3}{16}$ in. diameter perforations and is discharged through one end of the drum to the outlet branch of the strainer. Cleaning is carried out continuously by a scraper blade against which the drum rotates, the material removed falling into a sludge chamber at the base of the strainers. The chamber is purged at routine intervals to a 10 in. drain.

Determination of Pump Capacity

The specified duty of the pump unit was determined from a consideration of:

(a) The schedule of cooling water requirements.

(b) The maximum static head against which the pump would be required to work.

(c) The frictional head produced in the system at maximum flow.

The highest point on the delivery system is at the 'No-flote' control tank situated at the north-west corner of the power house; this level is +28.0 N.D. The lowest point on the intake system, taken as that of ordinary low spring tide level is −11.0 N.D. This gives a total static head at low water of 39 ft.

To this must be added the frictional loss in the delivery main under conditions of maximum flow calculated at 19 ft. for clean pipes, but to provide a margin to allow for encrusted surfaces this figure is increased to 26 ft.

The total maximum operating head is thus established at 65 ft. and reference to the schedule of consumption indicates that a unit having a nominal rated duty of 300,000 gal. an hour at 65 ft. head, but also having a capacity of 415,000 gal. per hour at a reduced head of 48 ft., is suitable at the initial stage. The flow characteristics of the supply system were plotted on a graph and the additive performance curves of one, two or three pumps of the capacity chosen were superimposed.

The significant points on this composite graph of system and pump characteristics were:

Point A—415,000 gal. per hour at 48 ft. head on the system characteristic curve for low tide conditions is the limit of the capacity of a single pump. This will meet requirements until the winter 1953-54.

Point B—650,000 gal. per hour at 62 ft. head on the system low tide curve is the limit of capacity of two pumps. Two pumps will be required for the winter 1953-54.

Point C—720,000 gal. per hour at 68 ft. head on the system low tide curve indicates a condition arising in the winter 1954-55. It will then be necessary to work three pumps at low tide.

Point D—730,000 gal. per hour at 68½ ft. head on the system low tide curve indicates the point at which the total head required under low tide conditions exceeds the available pumping head. At this stage, it will be necessary to duplicate the flow main for which provision has been made in the general scheme.

The ultimate requirements are of the order of 1,300,000 gal. per hour, with a flow of 650,000 gal. per hour through each main. The performance curve of two pumps working in parallel intersects the system low tide curve at point B (650,000 gal. per hour). The variations in duty due to tidal causes and the changes in requirements over the development period, can be met conveniently by the installation working at an acceptable level of pump efficiency.

Automatic Speed Control Pumps

In order to maintain a constant pressure in the flow main in spite of varying suction levels and varying demand, automatic speed control is provided for the 135 h.p. electric motors driving the pumps.

D.C. motors were chosen, speed control being by shunt field variation. Duplicate sets of mercury-arc rectifiers supplied from the works E.H.T. system are each capable of operating three pumps, and at the initial and intermediate stages of development provide 100% standby. As a further safeguard a diesel engine driven 260 kW d.c. generator was installed to enable the pumps to be operational in the event of a failure of any aspect of the works power supply.

Speed control is initiated by means of two sets of 'No-flote' controls mounted at different levels in a header tank of 5,000 gal. capacity in the water circuit. The difference in level between the two sets of 'No-flote' controls is small compared with the height of the tank above pump level, and thus an approximately constant pressure head can be maintained on the water supply system to the various plants. Should the pressure drop be such that the water level falls below the lower electrode of the lower 'No-flote' control, the shunt regulators are automatically moved in the 'accelerate' direction until the water level in the header tank has been restored to the high electrode of the lower 'No-flote' control. At this stage, adjustment of the shunt regulator ceases, and the motor will continue at a constant speed so long as the water level remains between the two 'No-flote' controls. Should the water level again drop below the lower electrode, further acceleration would take place, and, conversely, should the water level rise above the upper electrode of the upper 'No-flote' control, deceleration would take place. In the latter case, deceleration would cease when the level had fallen to the lower electrode of the upper 'No-flote' control.

Should acceleration cause a motor to run at its maximum speed a visible indication is given and the pump attendant starts an additional pump.

The two sets of 'No-flote' gear are connected to relays which in turn operate pilot motors on the main motor field regulators. The field regulators are all mechanically coupled so that when a number of pumps are running in parallel the speed of all motors, and thus the load on all pumps, is equal at any moment. When the 'No-flote' gear was first put to work the time taken for the pumps to accelerate or decelerate through their full range of speed, was 30 secs.; but as the time taken for the water level in the header tank

corrosion is already a considerable problem in this area of London.

After full consideration of these aspects, the decision was taken to adopt a river water pumping scheme to provide a main cooling system serving the new developments.

The first discussions on the general problem of cooling water supply took place on September 10, 1946, and the scheme now described went to work on July 3, 1950.

The pump house occupies a convenient site on the wharf-side and is approximately on the cross centre line of the works extensions. A natural continuation of this line gave a general location for the river water intake works in an acceptable area downstream of the lower coal jetty dolphin.

The Port regulations do not allow river works to be undertaken beyond the line of the jetty. The over-riding consideration at the intake is that the sill of the intake chamber should be covered under conditions of the lowest recorded tide. The tidal conditions provide the basic data for the scheme design and are summarised below:

Statutory flood protection level	+17.00 N.D.
Highest recorded tide	+16.74 N.D.
Mean high water spring tides	+11.74 N.D.
Mean high water neap tides	+ 7.90 N.D.
Mean low water neap tides	− 6.05 N.D.
Mean low water spring tides	− 9.10 N.D.
Lowest recorded tide	−13.60 N.D.

In order to establish stable conditions relative to the tidal movement of mud on the river bed in the intake area, it was decided to make the dredge level at this locality −16.8 N.D. This is conveniently the same level as that of the berth at the face of the jetty. The dredge level is 1 ft. below the sill of the intake chamber which gives a cover of 2 ft. above the chamber grid under conditions of the lowest recorded tide. The permanent protection work above the intake chamber is formed by eight 66 ft. long No. 4 section Larssen box piles, surmounted by a heavy reinforced concrete capping 5 ft. deep. The box piles were each filled with 2¼ tons of 1½ in. tarred granite. The four sides forming the perimeter of this dolphin are covered with galvanised woven metal screens of $1\frac{3}{16}$ in. mesh, running from the sill of the intake chamber at −15.80 N.D. to a height of +18.00 N.D. to prevent the intake of flotsam. These screens are made up in frames to form panels of reasonable size to facilitate removal and maintenance. To provide access for this operation, three platforms of R.S. channel section are welded to the inside of the box piles supporting a decking of 3 in. timbers. Three galvanised steel ladders give access to these platforms.

Intake Chamber

The intake chamber is constructed in reinforced concrete in the river bed within a coffer dam of sheet piling. It is formed in two compartments, one serving each intake main. The compartments are thus separated in order to avoid the danger of the silt ejected at this point by back-flushing being drawn in at the adjacent intake. The area of the horizontal openings to the intake chamber is 25 sq. ft. measured clear of the screen bars and supporting beams. These openings are protected by galvanised screens, consisting of ½ in. diameter bars welded at 3 in. centres each way.

The twin intake mains are C.I. socket and spigot pipes, 30 in. inside diameter, laid in the river bed with the fall of 1 in 50 towards the intake chamber, and are surrounded by concrete having a minimum thickness of 9 in. above and below the mains. They can be closed at the outlets of the intake chambers by means of penstocks operating from the capping level at the intake dolphin. The mains discharge into two pump suction wells or into the flushing chamber through 30 in. penstocks.

The intake main was originally envisaged as a single main of 42 in. diameter; but in the earlier years of development the reduced water requirement would have involved low rates of flow in the order of 1¼ ft. per second, with consequent heavy sedimentation. This led to the adoption of twin mains providing for the employment of one main in the initial and intermediate stages with flow rates under minimum take conditions of 2¾ ft. per second. This arrangement permits the alternate use of these mains for the main supply. At the pump house end they are connected through penstocks to a flushing chamber in which water can be impounded at high tide. If the water thus stored is released into the idle main at low tide, an effective back flushing of the mains and its section of the intake chamber is effected. The discharge of the flushing chamber by this procedure gives a reversed flow at 20 ft. per second, and 15 ft. per second under spring and neap tide conditions respectively. A raised division wall, 4 ft. high, between the intake chambers, prevents the ingress of the flushings to the working chamber.

Pumping Station

The structural design of the pumping station is of interest and has unusual features. Borings showed 20 ft. of sandy ballast lying 31 ft. below the surface and overlaying firm blue clay. Analysis of the ground water indicated that the sulphate content was sufficiently low to justify the use of portland cement.

The excavation to 45 ft. below ground level was carried out within a 61 ft. diameter ring of No. 3 Larssen steel sheet piling. To reduce ground water during construction, the piles used were 60 ft. long in order to reach and penetrate the clay. In pitching the piles, 60 ft. and 30 ft. lengths were pitched alternately but, before driving, a second 30 ft. length was butt-welded to the short length. The piles were driven in successive stages, the whole ring being driven 15 ft. at each stage. Beyond 45 ft., driving became very difficult and it was frequently necessary to burn off the top of the piles to clear the hammer legs. It is doubtful whether in all instances, the required penetration into the blue clay was realised.

Cross bracing of the coffer dam was avoided by constructing reinforced concrete ring beams at +8, +0.5, −6.0, −10.5, −16.5 and −22.5 (all levels N.D.) against the sheet piling. Excavation was carried down successively to each of these levels and the beam cast and cured before excavating to the next level. It is interesting to note that the strata agreed to within 3 in. of the levels obtained from the trial borings.

During excavation water was always present, but by sinking a sump well ahead of the excavation, a 4 in. diameter centrifugal pump was sufficient to keep the bottom dry. The sheet piling ring showed some discrepancies from true circle, but these were made good by varing the width of the ring beams to give a face circle true to practical limits. Soffit and back shuttering at outpan positions was carried by close mesh fabric welded to the sheet piling.

When bottom was reached seven sumps having standpipes interconnected with water levelling pipes were laid, and the floor was given a 6 in. blinding layer of high alumina cement concrete. A coat of tar was sprayed on to the top of the blinding, and covered with loose shingle.

At this stage, the 4 in. self-priming pump was kept in continuous use and a permanent watch kept on the water level in the sumps. A reserve pump was placed in position in case of breakdown and a further pump maintained to flood the base should a dangerous rise in hydraulic head be indicated in the sumps.

The 4 ft. thick floor slab was cast in seven parts, each part embracing a sump. At least three days curing time was allowed before placing concrete in an adjacent section. The whole floor was cast in 10 days.

In principle the walls were cast in 4 ft. lifts with slight variation in the first lift to allow for casting in the 30 in. diameter cast-iron pipes. The reinforcement in the external 30 in. wall was reduced to nominal requirements as the wall was cast monolithically with the ring beams. It was necessary from design considerations that pumping from the standpipes continued until all the internal walls were at least 10 ft. high,

and the sumps in the floor were not actually sealed until the concreting of the pump house had been completed.

The pump house basement houses the pumps, the suction wells and the flushing chamber. The pumps draw from the wells through bell mouthed suction pipes; the bell mouth looking downwards in order that the depth of water over the highest point of the lip shall not be less than 4½ ft. at the minimum low tide. This eliminates the possibility of vortex action and entrainment of air under maximum flow conditions. The pumps and the suction pipes are flooded at all states of the tide.

The pump control room, superimposed on the pump house standing just above ground level at +20 N.D., houses the motors driving the pumps and the rotary strainers on the delivery mains together with the penstocks controlling the admission of water to the suction wells and flushing chamber.

A battery of three vertical spindle centrifugal slow speed pumps will be served by each of two pumping chambers. The twin delivery mains are each provided with a rotary strainer, and the outlet to the system is designed to feed twin 30 in. diameter supply mains to the works, the first of which is at work. The pumps are driven from the control room by totally enclosed compound wound d.c. motors of 125 h.p. designed for automatic speed variation by shunt control. The discharge branch of each pump is fitted with a reflex valve.

The 'Deptford' rotary water strainer is designed to remove all debris and major solid particles passing the coarse screens at the intake. It consists of a perforated gunmetal drum mounted on spiders, which rotates within the cast-iron body. The water is delivered by the pumps to the outside of the drum, passes through the $\frac{3}{16}$ in. diameter perforations and is discharged through one end of the drum to the outlet branch of the strainer. Cleaning is carried out continuously by a scraper blade against which the drum rotates, the material removed falling into a sludge chamber at the base of the strainers. The chamber is purged at routine intervals to a 10 in. drain.

Determination of Pump Capacity

The specified duty of the pump unit was determined from a consideration of:

(a) The schedule of cooling water requirements.

(b) The maximum static head against which the pump would be required to work.

(c) The frictional head produced in the system at maximum flow.

The highest point on the delivery system is at the 'No-flote' control tank situated at the north-west corner of the power house; this level is +28.0 N.D. The lowest point on the intake system, taken as that of ordinary low spring tide level is −11.0 N.D. This gives a total static head at low water of 39 ft.

To this must be added the frictional loss in the delivery main under conditions of maximum flow calculated at 19 ft. for clean pipes, but to provide a margin to allow for encrusted surfaces this figure is increased to 26 ft.

The total maximum operating head is thus established at 65 ft. and reference to the schedule of consumption indicates that a unit having a nominal rated duty of 300,000 gal. an hour at 65 ft. head, but also having a capacity of 415,000 gal. per hour at a reduced head of 48 ft., is suitable at the initial stage. The flow characteristics of the supply system were plotted on a graph and the additive performance curves of one, two or three pumps of the capacity chosen were superimposed.

The significant points on this composite graph of system and pump characteristics were:

Point A—415,000 gal. per hour at 48 ft. head on the system characteristic curve for low tide conditions is the limit of the capacity of a single pump. This will meet requirements until the winter 1953-54.

Point B—650,000 gal. per hour at 62 ft. head on the system low tide curve is the limit of capacity of two pumps. Two pumps will be required for the winter 1953-54.

Point C—720,000 gal. per hour at 68 ft. head on the system low tide curve indicates a condition arising in the winter 1954-55. It will then be necessary to work three pumps at low tide.

Point D—730,000 gal. per hour at 68½ ft. head on the system low tide curve indicates the point at which the total head required under low tide conditions exceeds the available pumping head. At this stage, it will be necessary to duplicate the flow main for which provision has been made in the general scheme.

The ultimate requirements are of the order of 1,300,000 gal. per hour, with a flow of 650,000 gal. per hour through each main. The performance curve of two pumps working in parallel intersects the system low tide curve at point B (650,000 gal. per hour). The variations in duty due to tidal causes and the changes in requirements over the development period, can be met conveniently by the installation working at an acceptable level of pump efficiency.

Automatic Speed Control Pumps

In order to maintain a constant pressure in the flow main in spite of varying suction levels and varying demand, automatic speed control is provided for the 135 h.p. electric motors driving the pumps.

D.C. motors were chosen, speed control being by shunt field variation. Duplicate sets of mercury-arc rectifiers supplied from the works E.H.T. system are each capable of operating three pumps, and at the initial and intermediate stages of development provide 100% standby. As a further safeguard a diesel engine driven 260 kW d.c. generator was installed to enable the pumps to be operational in the event of a failure of any aspect of the works power supply.

Speed control is initiated by means of two sets of 'No-flote' controls mounted at different levels in a header tank of 5,000 gal. capacity in the water circuit. The difference in level between the two sets of 'No-flote' controls is small compared with the height of the tank above pump level, and thus an approximately constant pressure head can be maintained on the water supply system to the various plants. Should the pressure drop be such that the water level falls below the lower electrode of the lower 'No-flote' control, the shunt regulators are automatically moved in the 'accelerate' direction until the water level in the header tank has been restored to the high electrode of the lower 'No-flote' control. At this stage, adjustment of the shunt regulator ceases, and the motor will continue at a constant speed so long as the water level remains between the two 'No-flote' controls. Should the water level again drop below the lower electrode, further acceleration would take place, and, conversely, should the water level rise above the upper electrode of the upper 'No-flote' control, deceleration would take place. In the latter case, deceleration would cease when the level had fallen to the lower electrode of the upper 'No-flote' control.

Should acceleration cause a motor to run at its maximum speed a visible indication is given and the pump attendant starts an additional pump.

The two sets of 'No-flote' gear are connected to relays which in turn operate pilot motors on the main motor field regulators. The field regulators are all mechanically coupled so that when a number of pumps are running in parallel the speed of all motors, and thus the load on all pumps, is equal at any moment. When the 'No-flote' gear was first put to work the time taken for the pumps to accelerate or decelerate through their full range of speed, was 30 secs.; but as the time taken for the water level in the header tank

to respond to the speed changes was in excess of 30 secs., excessive hunting in pump speed was experienced. This was overcome by the incorporation of interrupter gear designed to permit the operation of the pilot motor for 5 secs. only in a period of 22 secs., the remaining 17 secs. at constant speed providing the requisite stabilising period. These intervals of time can be varied and were eventually chosen in the light of operational experience.

The Flow Main

This main is in cast-iron pipe throughout and leaves the rotary strainers at 30 in. diameter and continues in that size to the site of the new plant. After serving important users in this central area the main continues at 20 in. diameter and is finally reduced to 16 in. diameter at the terminal point of consumption at the wet purification plant. Immediately before the final reduction, a 20 in. diameter branch is connected to the return main at a point near the terminal of this latter main. The isolating valve on the interconnection is kept closed but is opened at routine intervals to give sedimentation control by augmenting the rates of flow in both the flow and return systems.

At a point near the power house an 18 in. riser from the flow main connects to an open header tank of 5,000 gal. capacity. This reservoir houses the 'No-flote' electrodes for the remote control of pumping rate and is provided with an adjustable overflow to the return main. The water level at this point is the highest in the system and the head is sufficient to supply the condensers at the turbo-alternators. All other users draw their requirements from the flow main through their individual pumping systems. Kinetic air valves are provided on the main at points adjacent to the pumping station, power house and the wet purification plant, and an 8 in. diameter sludge connection is fitted at the low point of the main.

The Return Main

This system leaves its terminal point at the wet purification plant as a 24 in. diameter main, increasing to 36 in. as the intake of reject water from the users progressively increases. To reduce the expense and inconvenience of main laying through an established works, the flow and return mains were laid where possible in a common trench. The return main discharges to an inspection chamber on the wharf as a 48 in. main and carries a branch which on future development will take the duplicate return main.

The main is laid to a fall of 1 ft. in 300 ft., and as the individual effluents enter it through open branches, close account had to be taken of the river flood defence level augmented by the frictional head applicable at these points of entry. This aspect is met in actual practice by feeding the effluents to the return main through standpipes of appropriate height. It will be appreciated that these considerations were closely related to the designed elevations of the units of plant served by the scheme.

As the flow through the return main is entirely due to gravity head, the estimates of rates of flow under varying conditions of head and volume were of fundamental importance. When the 36 in. main is running full, which would occur over a long section of its course at the period of high tide, the linear velocity at low flow of 200,000 gal. per hour would be 1¼ ft. per sec. At the same volume of flow the main would run partly filled at low tide, and the velocity would rise to 4 ft. per sec. This means that sedimentation in the main due to reduced velocities at high water would be scoured away at low water.

In an attempt to limit the heavy cost of civil engineering work in tidal conditions, consideration was given to a scheme for receiving the discharge from the return main on an apron covering an area of foreshore. It was found that even with an apron of totally unacceptable dimensions, the velocity of water leaving the sill of the apron would be sufficient to produce erosion of the foreshore. The alternative solution was adopted of carrying the 48 in. return main out below the foreshore to an outfall chamber sufficiently offshore to be covered at all states of the tide. The outfall chamber is, in fact, on the same out-river line as the jetty face and the intake chamber, which it follows generally in design with a covering grid and protective dolphin.

Operation of the System

The river water pumping station was put to work on July 3, 1950, and has been in continuous operation since that date. Up to December 31, 1952, some 7,000 mill. gal. had been pumped through the system.

It was appreciated from the commencement of operation that the water velocity of 5 ft. per sec., on which the scheme was generally based, would not be attained at this stage of development and that appropriate routine measures should be introduced from the outset if sedimentation in the mains was to be avoided. Operational procedure therefore includes:

(a) The two intake mains from the intake dolphin to the pumping station are used in turn for weekly periods, and the dolphin penstocks are operated and greased.

(b) Water is permitted to flow into the flushing chamber at the pumping station on each tide, and the intake main not in use at the time is back flushed to the river at low water.

(c) The 'Deptford' strainer in operation is back-flushed to the river for approximately one minute during each eight-hour shift, a period which has been found by experience to suit the particular conditions and ensures that the chamber at the base of the strainer is maintained clear of sludge. The capacity of the sludge chamber is 18½ cu. ft.

(d) The connection provided by the wet purification plant for back flushing the flow main to the return main at the farthest point of the system from the pumping station, is operated weekly, the valve being opened for a period of about 10 min. to ensure an adequate flow through the main.

(e) The 'No-flote' control head tank, where water velocity is at a minimum, is inspected and cleaned monthly, and some 4 cu. yds. of silt are removed on each occasion.

The demands of the various plants have not necessitated, so far, the output of more than one pump, except at unusually low tides or when the routine flushing of the whole system is being carried out. A routine has been laid down for pump operation and a specified pump is maintained at work, although every week both of the spare pumps are run for one eight-hour shift each to ensure that they are operational. The standby diesel direct driven d.c. generator is also run for two hours each week for similar reasons. Inspection of the 'Deptford' rotary strainers is carried out annually, but to date no excessive wear has been noticed or repairs found necessary.

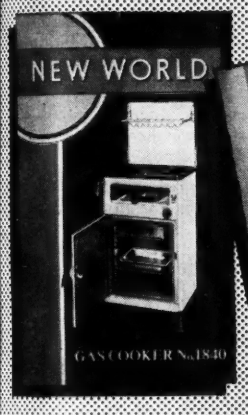
One pump only has been opened up for examination, and the casing and impeller were found to be in perfect condition. The surface condensers of the turbo alternators are opened up for inspection at six-monthly intervals, but little cleaning is found to be necessary. The working vacuum is readily maintained at 28½ in.

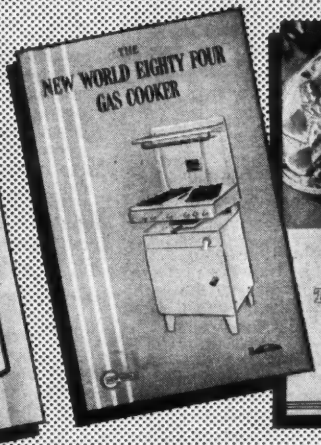
On the wet purification plant, the sludge cocks on the hopper bottoms of each unit of the primary and secondary gas coolers are operated once per eight-hour shift, and the sludge is flushed back into the return main to the outfall. The gas outlet temperature on the coolers is readily maintained within 1°F. of the inlet water.

Generally, it is the opinion that the whole installation has been functioning most satisfactorily and there is no reason to anticipate operating difficulties in the future.

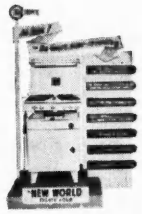
It is evident that the cost of river water will be highest at the initial stage and will progressively fall through the six intermediate stages of development to a minimum cost on completion.

(Continued on p. 456)





EIGHTY FOUR New World Gas Cooker
SHOWROOM DISPLAY



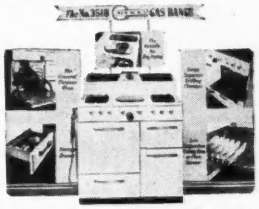
Strongly constructed and finished in a bright and pleasing colour scheme, this Showroom Display forms an attractive setting for this new and remarkably fine NEW WORLD Cooker.

Special attention is drawn to the salient features of the Cooker and the complete ensemble cannot fail to impress the prospective customer and stimulate sales.

The overall dimensions are:— 7-ft. 6-ins. high x 5-ft. 9½-ins. wide x 2-ft. 3-ins. deep back to front.

Radiation Ltd

No. 3518 New World Gas Range
SHOWROOM WINDOW DISPLAY

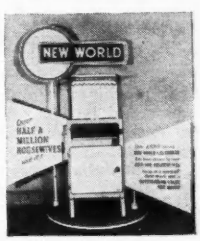


Here is a Window Display which is worthy of this very handsome No. 3518 NEW WORLD Gas Range. It shows, at a glance, in pictorial form, its five most important features.

The illustrations consist of beautifully-coloured photographs which at once attract attention and convey the story in a most effective way. Strongly constructed and easily and quickly installed. The overall dimensions are:— 6ft. high x 7ft. 8ins. wide x 2ft. 4ins. deep back to front.

Radiation Ltd

New World S4180 Gas Cooker
SHOWROOM DISPLAY



Here is a Showroom Display for the S4180 Series Cooker which has now passed its half million production mark.

Feature this Cooker and this Display in your Window—it will help to still further stimulate sales for this very popular model.

Finished in bold attractive colours and easily assembled the complete set-up measures 6-ft. 5½-ins. high x 6-ft. 2-ins. wide x 2-ft. 5½-ins. deep back to front.

Radiation Ltd

NEW WORLD NEW WORLD NEW WORLD

The power consumption measured over two years of working enables a firm estimate to be made of future requirements and costs at successive stages of development. The cost of attendance is low; the operation of this system and the water softening plant, and the control of raw water and boiler feed water storage, are carried out by one attendant per shift. The plant elements are of simple and robust design and it is expected, and experience to date confirms, that maintenance charges will be low.

The capital and depreciation charges are clearly high in the early stages of the scheme, as 78% of the full capital outlay had to be expended in order to cover the initial stage. This forward expenditure includes the final costs of the intake and outfall systems (examples of the considerable expense involved in river works), the pump house and the full cost of the initial flow and return mains. To carry the scheme to full development, the only requirement will be three additional pumps and motors, a further set of mercury arc rectifiers and the duplication of the flow and return main system.

DISCUSSION

Mr. F. M. Birks (Deputy Chairman, North Thames Gas Board) said this very practical paper had a special appeal to them north of the river, as their problems were so very similar. The authors were indeed wise to have kept the inlet mains at a level which meant that they were always covered at the very lowest spring tides. The North Thames Board had a similar arrangement at one of its works where unfortunately this wise provision was not made and it had been a source of continual trouble, particularly as they had not the excellent arrangements for flushing out which the authors had provided. On the other hand, the North Thames Board did not get this difficulty at any of its other pumping plants because they were incorporated with coal unloading jetties well out into deep water; the pumps were always installed right out in the river so as to cut out long and costly inlet mains. Although they had had one installation with rotary screens on the outlet of the pumps, they had always preferred the moving elevator type of screen so as to protect the pump itself as far as possible from flotsam; they had, in fact, fitted one to the installation which already had the rotary screens.

He was surprised to note that the authors had thought it necessary to control the speed of the pumps. The advantages of using alternating current were so great in all directions, except for variable speeds, that Mr. Birks had always subscribed to the use of constant speed motors, unless it was virtually impossible to carry out a particular operation by this means. The number of pumps, both water and gas, in a modern works that could with advantage be operated electrically was so great, and the saving in fuel was also very large when compared with steam or other sources of power, that it seemed to be straining at a gnat not to accept the simple squirrel cage constant speed motors and to rely on the excellent self-governing characteristics of the non-positive type of pump. With this arrangement there was never any difficulty in parelleling either gas or water pumps, the load always being equally divided up among the machines that were running without any special and complicated device. The North Thames Board used this method for large coke oven exhausters, hydraulics pumps up to 900 lb. per sq. in. and a host of other machines. In this particular case when a number of pumps could be run at will, he thought it very doubtful if there was any actual saving in current, and certainly it was most unlikely to be sufficient to justify the extra capital cost and maintenance.

After many disappointing experiences with variable speed a.c. motors perhaps he was biased, but at least he could assure the authors that the method they had chosen was by far the most satisfactory and in point of fact was the one most frequently used in the North Thames Board. It was in use on the charging machines in all their horizontal retort houses at Beckton; at the time when they changed over to alternating current some 30 years ago it was felt that the overhead conductors to the machines at 440 volts a.c. might be dangerous in view of the number of rods and bars that were lightheartedly used in the vicinity of the bare wires.

Mr. Birks said he was surprised to note the very large flow mains on the East Greenwich installation. Moreover, it was much cheaper to carry the mains overhead. With reference to the outfall he would have thought an ordinary oval shaped main would suffice; he had never experienced any problem in the erosion of an outfall apron.

A river water filtration plant was installed at Beckton and had been working for 30 years. It was very effective and removed a great deal of mud, but at several other works where they pumped the river water untreated directly into the system they did not find great difficulties, and they had not yet extended the system at Beckton or elsewhere; this confirmed the authors' experiences. The work described had been designed and carried out in the best engineering traditions, and he was sure it would give long and satisfactory service.

Mr. R. M. Farror (South Eastern) said the paper had been of particular interest to him not only because he had been concerned with the river water supply to Wandsworth works for many years but also because of the possible extensions to this works which were under consideration. The quantities of water required at Wandsworth at the present time were, of course, less than those required at East Greenwich and it had been possible to employ a different arrangement for pumping the river water, which was used for gas cooling, coke quenching and for general cooling purposes on other process plant. For all steam condensing units a re-circulating system employing forced draught cooling towers was used in conjunction with well or town water. It would appear to be possible with this system to provide colder water during the summer months and at the same time reduce the quantity of hot water returned to the river. Water was drawn from the river by vertical spindle pumps situated on a deck of the coal unloading jetty. The jetty projected some 120 ft. into the river and the strainers on the pump suctions were submerged to a depth of not less than 5 ft. at lowest tide level, so that water could be obtained at all times—although during the autumn difficulties were experienced due to the strainers becoming choked with vegetation brought down by the river. The pumps were fitted with mild steel spindles protected by gun metal sleeves which were renewed each year. The impellers were made of manganese bronze and had a working life of about five years. It would be interesting to learn if the practice at East Greenwich differed materially from that at Wandsworth in this matter.

No Sludge Difficulties

From the pumps the water was led by two delivery mains a distance of some 600 ft. to a battery of eliptical torrent filters containing graded granite and sand and each capable of filtering 20,000 gal. of water per hour. The flow through each filter was reversed for about half-an-hour every shift when the filtering medium was agitated by means of compressed air jets. At the present time the maximum water requirement was about 100,000 gal. per hour so that the velocity of the water through the pipelines was around 3 ft. per second, but no difficulty had been experienced with sludge deposits.

He was interested to note that experience gained at East Greenwich during the last 25 years indicated that the use of river water for gas coolers did not result in undue corrosion. Wandsworth experience in this matter had been varied, as tubes had been known to last in one case over 15 years, while another unit installed in 1938 required new tubes after five years. Sand filters had been in use for some 20 years and the small quantities of mud that did pass through these filters could conveniently be removed by flushing the various plant units. Before the introduction of the filters, however, heavy accumulations of mud collected in the water-ways of the various cooling units and seriously affected their continuity of use. It would, therefore, be interesting to know whether any difficulties due to mud deposits had arisen at East Greenwich since the new system was installed or whether the rotary filters had been so effective that mud had not been carried forward to the various plants.

The paper gave an interesting account of the precautions taken to control the hydraulic pressure during the construction of the coffer dam, and Mr. Farror would be interested to know the precautions taken in order to ensure water-tightness at the day-to-day construction joints. Finally, with regard to the water which was returned to the river, did the authors consider that back-flushing over a long period was likely to result in a build-up of sludge either in the outfall chamber or in the vicinity of the chamber?

Mr. G. Dougill (North Thames) observed that the paper was again what they all came to expect from their friends across the river—an absolutely complete comprehensive study of

whatever subject they chose for discussion. On the constructional and mechanical aspects he had no points to raise, but on the general problem of the supply of cooling water, he would like to make a few points. First, on the suitability of the water, Thames river water in its tidal reaches contained silt, organic matter—sodium chloride—had a hardness of about 100, and at periods of drought was liable to be much warmer than stated by the authors. As it was impossible in a complex water supply system to maintain the minimum rates of flow required to prevent settlement at all times and all places, they found it necessary at Beckton, to settle and sand filter it; the hardness prevented its use at high temperature or scaling might occur, and the presence of sodium chloride was very detrimental when used for quenching.

Secondly, they were now being discouraged from returning hot water to the river, and its use as make-up on a closed cooling system involved a large bleed to drain to prevent a dangerous accumulation of dissolved solids. It contained anything between 25 and 1,000 grains of salt per gallon according to the state of the tide and flow down the river.

All these considerations led to the conclusion that while filtered river water had a definite use on a Thames-side works, there was a very large number of applications where it was cheaper and both more desirable and efficient to use more expensive but purer water in a closed circuit usually cooled by a mechanical draught cooler. In fact, in many cases it was worth while softening the make-up water and even inserting a pressure sand filter in the closed circuit so that crsytal clear water was used continuously. This was particularly the case with gas condensation, since a mechanical draught cooler (which would not operate happily on river water) enabled the coolest possible water to be available during hot weather, and they were employing these methods with considerable satisfaction. The actual net consumption of the higher class water was only a small fraction of the amount circulated; the 'blow-down' from the system was small, and the combined power for circulating the water in the various streams might actually be less than the centralised power in the river water scheme. But the capital cost of the numerous cooling towers was, of course, additional, as was the power required for the mechanical draught fans.

The benefits were mainly two-fold—the lower temperatures which were possible and the great reduction in corrosion. At a very general estimate it would appear that their net intake of town and river water would ultimately be approximately equal, though the town water, due to its repeated use, would perform much more work. He would greatly value the authors' views upon this aspect of the problem.

Authors' Reply

The Authors, replying to the discussion, thanked Mr. Birks for his highly original and arresting views. They had, initially, considered in principle the incorporation of the pumping station with the coal unloading jetty. In the local circumstances, this proposal was rejected for the following reasons: (a) A major modification of a relatively old structure was required; (b) the erection of additional coal handling plant on the jetty was already anticipated, leaving little margin in the adequacy of the structure; and (c) the vulnerability to damage of key plant erected in a busy reach of the River Thames.

The use of a moving elevator type of screen to protect the pumps from flotsam was discussed at the outset with the pump makers, but it was considered that the employment of $1\frac{3}{16}$ in. mesh stationary screens at the intake was a sufficient safeguard and that any material passing through this mesh would be safely handled by the pumps. This conclusion had been borne out in practice and no trouble had been experienced at the pumps from blockage; nor had any damage occurred to the impellers. Cleaning of the stationary screens had also been found to be unncessary and the reversals of the tide no doubt contributed to this effect.

In considering whether the pumps should be of a variable or a constant speed drive, account had to be taken of the wide range of volumetric throughput required with its consequential effects on the frictional resistance of the system, coupled with a variation in the 'static' head due to tidal conditions. The manometric head variation could be 48 ft. If the machines were run at constant speed, that speed must be sufficiently high to give the maximum required output under the most adverse conditions of total head, and this would result in excessive power consumption when the conditions were less onerous. Consider, for example, the position next year when the plant would require to pump about 520,000 gal. per hour with two pumps in parallel operation. The total actual head against the pumps would be 54 ft. at low spring tide and 29 ft. at high tide. The low tide conditions could be met by running the pumps at a speed of 735 r.p.m., each pump absorbing 90 B.H.P. At high tide the pump speed would be 620 r.p.m. absorbing 60 B.H.P. The power requirements for the two pumps would average 150 B.H.P./hr. throughout the tidal cycle. Under the varying conditions, a constant pressure head would be maintained where actually required—that was, at the water supply system to the various plants. With constant speed machines designed for the maximum possible output, the power requirement would be 270 B.H.P., or 80% greater than for the variable speed units. Their experience over the last $2\frac{1}{2}$ years, indicated that with constant speed motors the power costs would have been greater by between $\frac{1}{4}$d. to $\frac{1}{2}$d. per 1,000 gal. pumped. On full development the choice of variable speed d.c. motors would effect a saving of £11,000 per annum in power costs, which substantially offset charges on the £10,000 additional capital cost of the d.c. equipment. Simple squirrel cage constant speed motors were in almost universal use at East Greenwich, but it was felt that, in this particular instance, the constantly recurring wide range of pressure head conditions prevailing justified the higher prime cost of the variable speed drive. It was interesting to note that employment of direct current motors as being more satisfactory for this purpose than variable speed a.c. machines was a choice which was confirmed by Mr. Birks' experience.

Account was taken of the final volumetric throughput and its effect on the friction losses when determining the size of the flow main. With the 30 in. diameter mains installed between the pump and the header tank the friction loss under conditions of maximum flow was calculated at 26 ft. This figure would have been increased to 63 ft. if the size of the main had been reduced to 24 in. diameter and this would have materially affected the power requirements of the pumps. It was considered that the volumes required, in relation to the lengths of main involved and the characteristics of an economic pumping system, fixed the acceptable size of the flow main at 30 in. diameter.

Case for Underground Mains

The return main had to be run at low level to provide a gravity flow to the river. The flow main followed the same route as the return main for about three quarters of its length. It was therefore logical to lay the flow main under ground and accommodate the two mains in a common trench. By laying the flow main in this way it was possible for it to rise uniformly through the works from the strainers to the point of the last take-off without the possibility of air locks and interference of access to works plant. It was considered desirable for the main to be in cast iron and if it had been carried overhead a supporting trestle would have been required at each joint and the nature of the ground at East Greenwich would have necessitated piling for each trestle. On balance, it was felt that a strong case was made out for running the flow main underground.

The cast-iron pipes forming the outfall main were of standard circular shape. This main was flooded throughout its entire length for several hours before and after high tide, during which periods the velocity of the water would be a function of the total cross-section area of the main and would lose the advantages of the velocity gained from the invert of an oval shaped main.

In weighing the use of an out-fall apron against the method adopted, consideration must be given to the quantities of water involved, as the scheme would eventually provide for a return to the river of about $1\frac{1}{2}$ mill. gal. per hour. It was considered that this volume would be likely to cause erosion of the foreshore even when discharged to an apron of substantial dimensions, and on consulting the hydraulic division of the National Physical Laboratory it was confirmed that under low water conditions a considerable standing wave would be created with probably 7 ft. depth of erosion over a width of 40 or 50 ft. at the end of the apron. The apron would entail coffer dam construction similar to the out-fall main now installed.

In reply to the point raised by Mr. Farror, the pump shafts were protected with renewable bronze sleeves where they passed through the stuffing boxes. Their experience of wear

(*Concluded on page 460*)

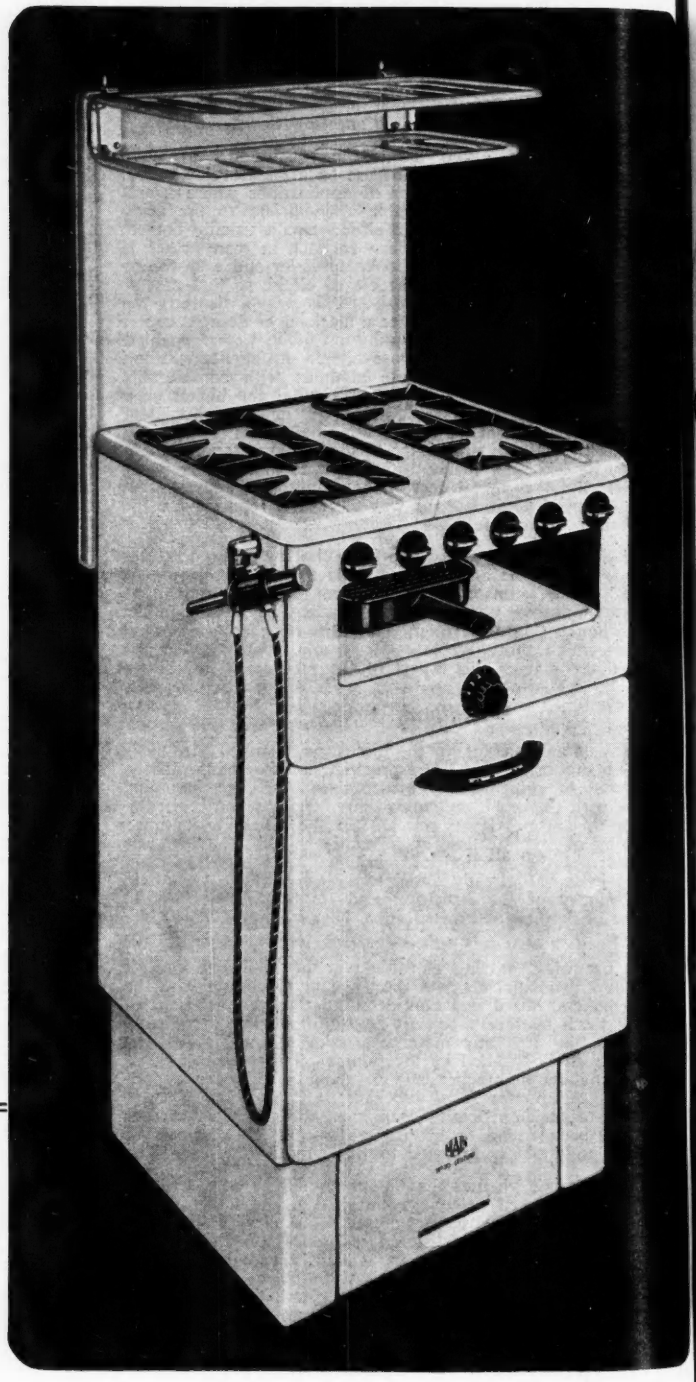
No. 20 CENTURY

The luxury Cooker at a moderate price

PROVIDES A HIGH STANDARD OF PERFORMANCE COMBINED WITH EASE OF MAINTENANCE

The No. 20 Century is of advanced design and constructed primarily of sheet steel. No chassis is used; its great strength and solidity being achieved by the use of large steel panels with deep flanges bolted together.

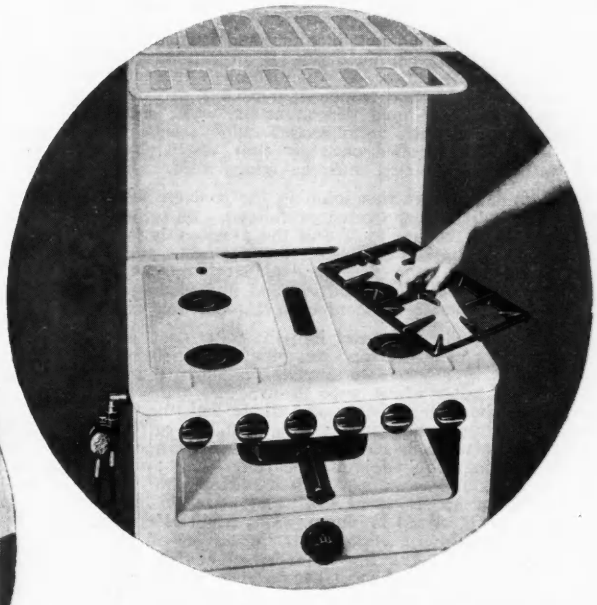
The overall dimensions of the Cooker are 36 ins. high, 20¾ ins. wide and 20 ins. deep. With back-plate and platerack the height is increased to 53 ins. and the depth to 20¾ ins. overall.

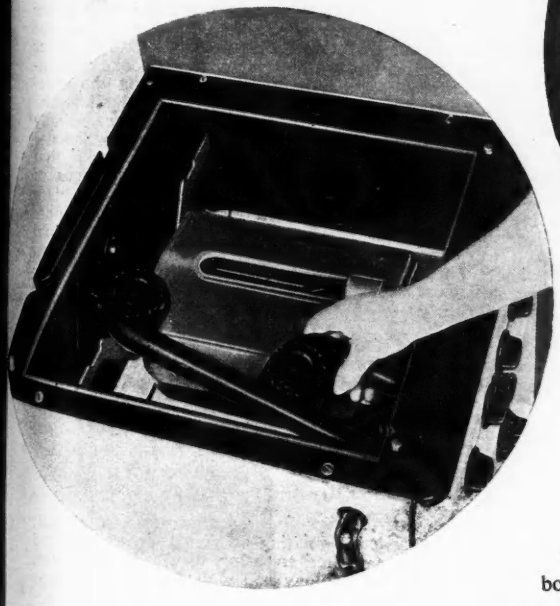


MAIN

R. & A. MAIN LIMITED
LONDON AND FALKIRK

Its Hotplate, too, has unique maintenance features





The loose hobplate of the No. 20 CENTURY is fitted with two double pan supports of cast iron, finished in heat-resisting vitreous enamel. These are interchangeable right to left and are reversible back to front. The four high-speed boiling and simmering burners, cast in tandem pairs, are also interchangeable. Thus only one pan support unit and one boiling burner unit need be stocked for replacement purposes.

The boiling burners (cast in pairs) have a stable three-point support at the injectors and on the burner carrier. The latter is loose and reversible. When in place, it acts as a stop for the correct positioning of the grill pan.

The fixed injectors are recessed behind the cock shield and when all the loose parts have been removed a perfectly clean "wipe out" of the hotplate well is obtained.

A small hole in the right-hand side of the hotplate well provides access to the push button of the governor.

The quick-heating griller has large frets of heat-resisting steel and these provide a large toasting area. The frets are protected from spillage by a heat-deflecting hooded grill cover. The grill pan has a close mesh cross wire grid to support small pieces of food and is reversible, affording two grilling heights.

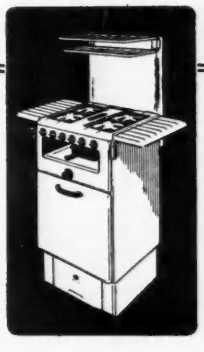
The tap handles and the mainstat numbered knob are "pull-off" types to facilitate removal of the facia plate. The oven tap has a distinctive red marking. Flanges on the taps eliminate possible damage to them during maintenance.

Hotplate Extensions

When supplied, the Extensions are hooked to small brackets fixed at the front and back of the cooker by means of existing screws. The Extensions are interchangeable right and left and are provided with horizontal alignment and levelling screws.

In CREAM Vitreous Enamel

Gas Cooker



562